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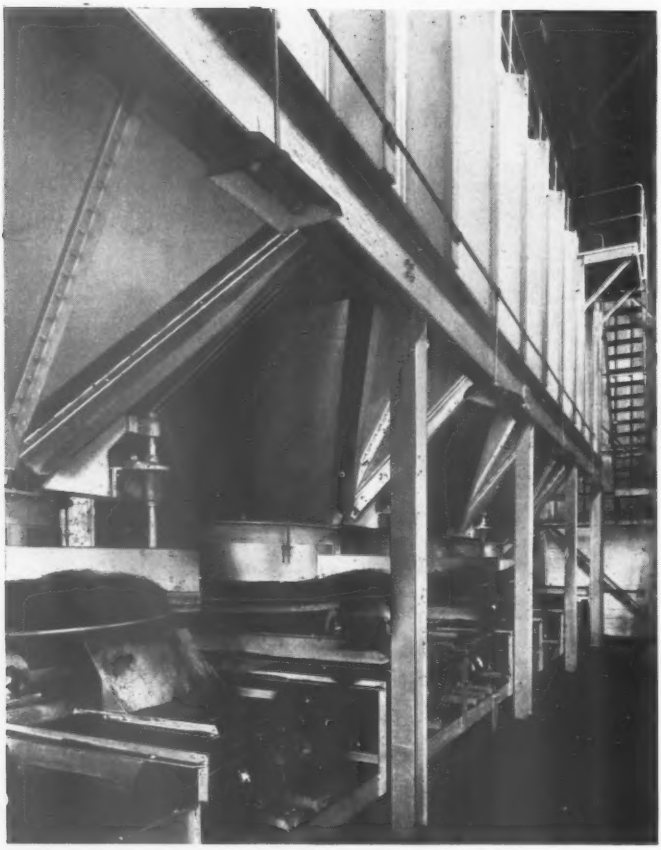

Photograph shows:
Four large storage hoppers, with rotary table feeders, ploughing off reconditioned moulding sand on to a troughed Belt Conveyor for transfer to the mixing station.

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FOUNDRY
TRADE JOURNAL

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Foreign Trade

Three papers have recently been read before the Royal Society of Arts, dealing with British trade. The first one, covering Latin America, which takes 5 per cent. of our exports, was by Sir John Taylor, K.B.E., C.M.G. It is a market which is constantly changing and therefore demands a continuous survey. For instance, but a few years ago, there was a 40 per cent. ratio for both consumer and capital goods, with the other 10 per cent. taken over by fuel and lubricants. In recent years, the balance has swung in favour of capital equipment to the extent of 56.3 per cent.—a factor favourable to the foundry industry. The author made the following important statement: The great depression of the early 30's showed up the weakness of the Latin America dependence on the United States. Commodity prices fell, American investment and tourist traffic stopped, causing financial crises and all their attendant evils. "Ever since that time, Latin American statesmen have been anxious to rebuild and expand trading relations with Europe, and to avoid excessive dependence on the USA." This policy is taking shape with resulting benefits to both Latin America and this country.

The second lecture, on trade with the Dominions, by Mr. G. S. Dunnett, C.M.G., O.B.E., also stressed the changing pattern of trade The total pre-war volume of exports has been doubled and one quarter of our national output is shipped abroad. Engineering products are now nearly half the expanded total, compared with a quarter pre-war. So far as foundry equipment is concerned, the expansion has been of even greater proportions. Other changes in which the foundry industry are interested is the increased exports of coffee-plantation machinery to Kenya and tea machinery to Africa.

The final lecture on "Trade with Western Europe," by Mr. Roger Falk, O.B.E., contains well-phrased and simple statements about the European Common Market and Free Trade Area. However, as would be expected from the lecturer's background, much attention was devoted to market research. Unlike the Commonwealth market, where English is the *lingua franca,* and London the cultural centre, the Western European one has a diversity of tastes, and designs acceptable to the Scandinavian buyer would possibly be a "flop" in the South of Europe. The lecturer, referring to the appointment of national and local agents, pointed to the danger of their being either too big or too small. The too-big agent in our experience confines his attention to his most profitable and easily-handled lines to the exclusion of those requiring an expenditure of energy and selling ability. One foundry, also making tool steels, generally appoints two agents in any one country for these two lines. They must have had the similar experience to ours.

Carbon-dioxide Process

Imperial Chemical Industries, Limited, has issued the following statement about the CO_2 Process as used in foundries:

Imperial Chemical Industries has reached an agreement with the Czech patentees of the carbon-dioxide/sodium-silicate process for making foundry moulds and cores, which promises to clear the way for further development of this attractive process in Britain. The process, in many ways a striking advance on traditional methods, has already been fairly widely accepted into foundry practice in the United Kingdom, but uncertainties surrounding the future of British patent No. 654,817 may have hampered its full development here. This patent lapsed in 1953, and an application made in 1954 by the patentees (*Vitkovicke Zelezarny Klementa Gottwalda* and Dr. Ing. Lev Petrzela, of Czechoslovakia) for its restoration is at present before the British Patent Office.

By an agreement with VZKG, and Dr. Petrzela, ICI has secured an exclusive licence under the patent, if restored, with the right to grant sub-licences, and these will be offered to the foundry trade free from royalty. Independently of the restoration of the patent, ICI has secured full access to all the technical information at present in the possession of VZKG and Dr. Petrzela, and any that becomes available from their continuing research work on the process in Czechoslovakia. This agreement promises to release much valuable information to the foundry trade in this country.

It is the wish and intention of Imperial Chemical Industries, Limited, to use these newly-acquired facilities in conjunction with those already in its possession to encourage the further development of the CO_2/silicate process in Britain wherever the circumstances are appropriate to its use. To this end ICI technologists have already visited major foundries and research organizations in Czechoslovakia to acquire the detailed and extensive knowledge of the process that ten years of intensive development have established there.

So far, in this country, the process has attracted particular attention in the casting of iron and non-ferrous metals. It has been adopted only to a minor extent in the production of steel castings. In Czechoslovakia, by contrast, some of the most spectacular technical and economic developments connected with the use of the process have been in making castings in steel, and in that country such application is well-established on a major industrial scale.

In its essentials, the process is a simple one. A sand of suitable grain-size and low clay-content is mixed with a sodium-silicate solution of appropriate silica: soda ratio and viscosity, and the mixture is then rammed into coreboxes or around patterns in the traditional way. Alternatively, the sand mass may be formed and contoured by strickling, or it may be built up into core or mould form by methods normally employed with loam. The moulds or cores are then hardened by gassing with carbon dioxide. Hardening is extremely rapid, and casting may follow immediately afterwards—no stoving is necessary. The process has many attractions:—Simplicity; versatility; high dimensional accuracy of the cores and moulds and the speed with which they can be made; elimination of the time-consuming and expensive stoving operation, and greatly-reduced fume nuisance, etc. It can be brought into operation with little capital expenditure, since it can be employed with orthodox foundry machinery.

Forthcoming Events

OCTOBER 20

North-East Metallurgical Society

"High Strength Weldable Steels," by K. J. Irvine, B.Sc., PH.D., 7.15 p.m. at the Cleveland Scientific and Technical Institution, Middlesbrough.

Institute of Vitreous Enamellers

Midland section: "Colour Matching," by W. Ball, 7.30 p.m., at the Birmingham Exchange and Engineering Centre, Birmingham.

National Society of Master Patternmakers

Visit to the tobacco factory of W.D. & H.O. Wills, Newcastle-on-Tyne; assembly at the Douglas Hotel, 1.45 p.m. Works visit to be followed by a dinner and social evening.

OCTOBER 21

Institute of British Foundrymen

East Anglian section: Visit to Lake & Elliot, Limited, Braintree, Essex, commencing 2 p.m. At 7.15 p.m., in the Pavilion of the company, induction of new president and presidential address.

Slough section: "Modern Developments in Aluminium-base Casting Alloys," by H. J. Profitt, at 7.30 p.m. in the Lecture Theatre, High Duty Alloys, Limited, Slough. (Liaison meeting with the London branch.)

Institution of Chemical Engineers

London branch: "Exploratory Study of the Flow of Granules through Apertures," by R. L. Brown and J. C. Richards, 5.30 p.m., at the Geological Society, Burlington House, W.1.

OCTOBER 22

Institution of Production Engineers

Norwich section: "Die-casting—How Would You Make It?" by A. R. L. Chivers (sound and colour film), 7.30 p.m., in the section room, Assembly House.

Institute of British Foundrymen

Birmingham branch: "Shrinkage and Porosity in Grey-iron Castings," by I. C. H. Hughes, M.Sc., A.I.M., of the British Cast Iron Research Association, 7.15 p.m. in the James Watt Memorial Institute, Great Charles Street, Birmingham 3.

London branch: "Solidification of Cast Iron and its Effect on Structure and Properties," by H. Morrogh, 7.30 p.m., at the Constitutional Club, Northumberland Avenue, London, W.C.2.

Institution of Mechanical Engineers

Education Group: Discussion on "Recent Developments in Engineering Education in the United States of America," 6 p.m., at the Institution, 1, Birdcage Walk, Westminster, S.W.1.

OCTOBER 24

Institute of British Foundrymen

East Anglian section: Dinner and social evening, 7 p.m., at the Oriental Cafe, Westgate Street, Ipswich.

OCTOBER 25

Institute of British Foundrymen

Newcastle and district branch: Works visit to R. W. Colin, Limited, Pallion, Sunderland. (Details from secretary.)

British Junior Chambers of Commerce

Sir Arthur Smout opened the 1958 national conference of British Junior Chambers of Commerce which was held in Birmingham from October 3-4. He said that there was an encouraging picture of Britain rapidly recovering her economic position and financial strength, so that the future could be viewed with optimism, and that Britain's position in the export markets, particularly in North America, was astonishing a world which only a few years ago was certain that Britain's business men had lost their grip, and her artisans their skill. He continued by saying that Britain's detractors abroad were now once again looking to us with respect for leadership and guidance, not only in science, technology, business, industry and commerce, but also in world affairs. Sir Arthur added that whether this country could continue to command that respect depended very largely on the under 40's, and how far they would develop over the next few years in leadership and depth of character.

Quality Control of Melting Stock for Investment Founders*

By L. S. Taylor

This paper is principally concerned with those problems encountered in the production of steel melting stock, though the same general arguments may be applied to most other materials. It is unfortunately true to say that it is easier to produce steel in its worst physical form by casting than by any other process. This is particularly true when the rate of cooling is retarded by casting into refractory moulds of low-thermal conductivity and at high temperature, as is the case with the majority of investment castings. The problems mainly range themselves into those of the influence of tramp elements, and improvements resulting from vacuum melting. In these aspects the work has direct application to many other types of founding.

This paper covers a survey of some of the factors which have been found to effect the quality of melting stock and the subsequent effect they may have on the physical properties of the castings. The need of safeguarding both customer and supplier by acceptance tests is stressed, with suggestions as to how this may be achieved.

As is well known, cast materials are susceptible to segregation, precipitation, unbroken networks of microconstituents, grain growth during solidification and cooling, and many of the harmful effects introduced by these changes, once present, cannot be removed by heat-treatment. This may be qualified by saying that correct heat-treatment is beneficial to the microstructure, but usually has little effect on the macrostructure.

Founder's Tasks

The task confronting the founder in producing a certain level of physical properties is much greater than those, say, in the forge where wrought materials are handled, and where reductions of 99 per cent. of the original cast structure are often achieved by the time the product is in its final shape. All of this work is continuously breaking up the deleterious influences of casting on the structure. What may be satisfactory wrought material can—even when employing the best melting techniques available to the investment founder and using his small melting units—give totally unsatisfactory physical properties in the casting or cast test-piece.

This may not be a reflection on the founder, but may be related to the characteristic properties of the steel with an as-cast structure, as opposed to its properties when the structure has been broken down by working. To illustrate this point, it is known that a continuous film of embrittling aluminium nitride, precipitated out at the boundaries of a coarse-grained cast steel structure during slow cooling, will play havoc with the impact properties, reducing their values to as much as one fifth of those normally obtained. These embrittling films lose their significance, however, when the material is processed and they become broken up and discontinuous. However, on remelting and slow cooling, the films will occur again. Thus, it can be seen that the mechanical properties obtained from wrought stock may well be misleading in assessing the resultant mechanical properties of that material when produced as an investment casting.

Factors Involved

If, for a given specification of material, and its heat-treatment, a consistently-high level of physical properties is required, it would be wise for founders to base acceptance of the material on the properties obtained from re-melt test-pieces, in addition to the normal composition as-cast. What are the fundamental factors affecting the quality of the material? These may be given as:—(1) Composition, (2) tramp elements, (3) gases, and (4) non-metallic inclusions.

Composition will be considered first. Melting stock for use by investment founders is nearly always supplied to a given composition range for the major elements. Fortunately, the composition ranges acceptable by the industry do not set the steelmaker many problems. There are, of course, exceptions, such as Niobium and Titanium, which can be elusive if restricted to a narrow composition range. What problems there are are concerned with segregation, contamination and heterogenity.

Uniform composition throughout the melting stock is particularly important to investment founders, because only relative small amounts of metal are used for each cast, and any variation in composition will be reflected in the small volume of metal forming the charge. Segregation in the

* Paper presented at the European Investment Casters' Association's Congress in Paris. The Author, who was previously with Deritend Precision Castings, Limited, is now chief metallurgist of G.L. Willan, Limited.

Quality Control of Melting Stock

melting stock is not a problem in the author's works. The stock is normally supplied in sticks from ⅞-in. dia. to 1¼-in. dia. produced from graphite moulds. Solidification is extremely rapid, only three to four seconds being necessary before the metal freezes, and the moulds are parted and the bars removed. The relatively small cross-sectional area, coupled with the rapid rate of freezing, adequately safeguards against segregation occurring in the stick.

This may not be true with a bar produced by more conventional methods of working down an ingot to stock size. Segregation within the ingot, which becomes more marked with increasing ingot size, may persist into the finished bar and lead to variation within the cast; the degree of variation depending upon the initial segregation in the ingot.

Segregation within the molten bath has not been a problem at the author's works, using high-frequency induction melting. As an exception to prove the rule, however, some problems have been encountered when dealing with the nickel-base "high-temperature" alloys in which it was necessary to alloy aluminium and titanium. Special procedures have had to be employed to overcome segregation due to flotation of the lighter alloys within the molten bath, giving differences in composition between top and bottom of the melt.

Another possible source of variation of as-cast composition within the intended range is contamination from the lining. Strict methods of working must be adhered to, to ensure that similar compositions follow each other in the same furnace lining and that "wash" melts are employed before changing to different types of alloys. The author's firm is helped in this respect by the nature of their furnace equipment. As mentioned previously, the firm employ high-frequency induction melting, and each furnace is provided with two furnace bodies. This permits each furnace body to be kept for a particular type of alloy, giving flexibility of operation. Another factor is that relining of 10-cwt. and 5-cwt. capacity high-frequency furnaces is not such a major undertaking as, say, the lining of a 3-ton arc melting furnace. This means that linings can be changed more to keep in step with technical considerations rather than economic ones.

Tramp Elements

Contamination of a melt from the furnace lining is a very real danger and correct melting-order, together with a classification of linings, is essential to avoid divergence from the composition aimed at, and pick of "residual" elements.

Having produced material to the desired composition range, it is not unusual to find that casts of similar composition, as indicated by analysis of the major elements, show a wide divergence of mechanical properties, even though given identical treatment. Why is this? One part of the answer lies in the presence of what may be called "tramp" elements. These are defined as those residual elements present in relatively small amounts which are normally introduced with the steel scrap when making up a furnace charge. The amounts present are relatively small and often go undetected, so that the usual certificate of composition, which will quote the percentages present of major elements only, will not indicate possible variation in properties from cast to cast of the same nominal specification. These small residual or "tramp" elements can strongly effect the mechanical properties of the steel. This is particularly true when coarse-grain as-cast structures are considered, where segregation and/or precipitation of harmful "residuals," which are undisturbed by mechanical working, will be in such a form as to exert the greatest effect on the properties for the amount present. These effects can be very marked, as the writer found in connection with the impact properties of 12 per cent. chromium and 3 per cent. chromium/molybdenum steels.

Charge Materials

The introduction of harmful residuals into the charge can be overcome by the careful selection of the furnace charge-materials. One method is to exclude steel scrap from the charge make-up, using virgin materials throughout. It is essential then that this virgin base selected should be from "proved" ore deposits of known purity where steel scrap is not used during manufacture.

Alternatively, only steel scrap of known composition may be used, but this method is difficult to apply satisfactorily because of the difficulty of: (*a*) determining that the sample or samples analysed are representative of the scrap submitted; (*b*) knowing what elements to check for, and (*c*) determining the gross effect of varying amounts of different elements. It is, of course, much easier to evaluate in detail a particular grade of virgin material and then use it exclusively, than it is continually to try to assess the merits of incoming batches of steel scrap.

Gas Contamination

Another factor influencing physical properties of the steel is that of gas in the melt. Here again, it is unusual (though not unknown) to quote the gas content of an alloy on the certificate of analysis. The three gases with which founders are concerned in steelmaking are oxygen, nitrogen and hydrogen. An oxidized bath with its consequent carbon "boil" is advantageous in removing occluded gases, and in segregating the non-metallic inclusions from the melt into the slag. Sufficient time should be allowed, however, between "killing" the steel and teeming, to allow the non-metallic inclusions formed during killing to float and separate out into the slag. If sufficient time is not allowed, then a "dirty" steel will result. Dirty steel is undesirable for many reasons, amongst them being that the physical properties are lowered and are not so consistent. However, the effect of such impurity is not so critical or as harmful as those effects which can be brought about by nitrogen and hydrogen.

Nitrogen

Nitrogen appears in its most deleterious form in steels as aluminium nitride, which is formed by precipitation during slow cooling between 1,300 and 900 deg. C. When existing in this form as a semi-continuous film, at the grain boundaries, it will give severe embrittlement with consequently poor ductility and low impact strength. The author's firm therefore aim to produce aluminium-free steel and because of this, killing with aluminium is avoided in their steel-melting shops.

Careful selection of ferro-alloy additions is also necessary as these can be another source of aluminium pick-up. This is particularly important with chromium steels, where there is a greater likelihood of nitrogen pick-up and where steps have to be taken to reduce nitrogen pick-up from the atmosphere, particularly after chromium has been introduced into the melt.

Hydrogen

Hydrogen embrittlement usually takes the form of hair-line cracks after hardening and tempering the castings. Quite often, these are undetectable to the naked eye, but are clearly shown up by crack-detection methods and micro-examination. For highly-stressed parts, particularly if subject to fatigue conditions, a marked reduction in the service "life" can be expected.

Hydrogen can pass into the melt in many ways, such as the use of damp charge-metals, the presence of hydrated corrosion products on scrap; damp refractories in the furnace and ladles, and pick-up from the atmosphere on damp days. When introduced at the beginning of the melt, the gas will tend to be removed during the melting processes, but hydrogen introduced during the later stages of melting and finishing can prove troublesome. For this reason, attention is directed to the condition of the "finishing" additions, and to the dryness of the furnace spout, handling ladles and shanks.

Crack Susceptibility Test

If hydrogen is easy to pick up, it can also be removed in a straightforward manner. This may be done by heating to about 680 deg. C. for three hours, after which time the majority of the hydrogen will have diffused out. It is debatable when is the best time to carry out this treatment, *i.e.*, by the steelmaker or by the founder of the finished castings. An important point is to determine when hydrogen removal is necessary. With this in mind, the author's firm is considering applying a routine test to each cast to determine the susceptibility to hair-line cracking after hardening and tempering. It is too early to say if this can be recorded as a practical check on the hydrogen content, but it would appear to provide some safeguard against hair-line cracking.

From the foregoing, it may be wondered why the author's firm concerns itself with producing steel stock for remelting, but it must be pointed out, of course, that they have gone, as it were, looking for "skeletons to rattle," so as to emphasize those problems which are exercising their minds and to illustrate to investment founders that, contrary to popular belief, makers of materials for remelting have the founders' interests and melting problems at heart. What the firm has tried to show is that, though a certificate of analysis covering the major elements is essential in the acceptance of metal, it provides only part of the information necessary in assessing its quality.

"Proof of the Pudding"

Of fundamental importance is the level of physical properties obtained from cast test-pieces produced under given conditions and heat-treatment. The founder would then know that the metal he was receiving was of proved quality, in a condition in which he could use it, and that any variation in properties was within his own control. This is a safeguard on both sides, as it protects the supplier from complaints, the cause of which originated in the investment foundry, and it also protects the founder from receiving sub-standard stock to begin with. Also, the steelmaker is aware of what quality of steel the founder requires. This is similar to the procedure believed to be adopted in the British Standard Specification for cast copper-base and light alloys, and the author feels sure there is much to recommend it to the investment founder.

Costs

The cost to the founder of the additional testing of material before delivery would be of the order of 1d. to 2d. per lb. When this is compared with a selling price of, perhaps, 25s. or 30s. per lb. for a finished investment casting, it seems a small price to pay for the safeguards provided. A more-expensive step would be the elimination of steel scrap from the charge for those steels requiring a high level of physical properties. If metal was ordered against physical properties, in addition to cast composition, it would then be the responsibility of the steelmaker to grade his charge materials so as to give the level of properties called for by the founder. This level of properties would then control the price of the metal. In this way, stock intended for unstressed commercial-quality castings would be produced under different conditions, and at different prices, from stock intended for high-quality castings.

The present arrangement for purchasing steel stock is unsatisfactory, since more often than not the steelmaker has little or no knowledge as to what properties the metal will be called upon to withstand. Since the melting and pouring equipment of most investment foundries can be regarded as re-melting and casting machines only, to a great extent the quality of the steel is determined before it reaches the investment founder. As a safeguard to both the steelmaker and the founder, materials supplied against specific requirements should be based where necessary on physical testing, in addition to the cast analysis results. Such conditions of supply to the founder should result in benefit to both founder and steelmaker.

Quality Control of Melting Stock

DISCUSSION

Opening the discussion, the president, Mr. Meerkamp van Embden, thanked Mr. Taylor for his excellent exposition, and asked him a question on carbon pick-up which might result from casting bar stock (for remelting) in graphite moulds. Mr. Taylor answered by saying that, provided a close control of technique was kept, the danger of carbon pick-up under these conditions was negligible. In contradiction to American practice, the author continued, where mostly prefabricated melting stock was used, about half of the present European investment casting firms were using mostly virgin materials, which were melted down in the crucible. As a matter of interest, at this point Mr. Meerkamp van Embden took a vote in the audience and the result was that eight casters present said they used premelted stock and 10 virgin materials.

Vacuum Melting

A member asked whether vacuum melting eliminated differences between satisfactory and unsatisfactory bar stock destined for remelting, and inquired the extra cost when using vacuum melting. Mr. Taylor replied that vacuum melting was not the answer to all quality questions, as it did not eliminate "tramp" elements, which might, in special cases, even be picked up from the crucible. As to cost, for small melts a premium of 3s. to 4s. per lb. was mentioned for vacuum melting. The chairman interjected here to say that in the USA vacuum melting was carried out in two ways. The first method was that remelting was carried out completely in vacuum, and the second that the ingots were prepared in vacuum, and the remelting proceeded with in the usual way. In answer to a question about pre-testing of bar stock, the author said his firm used test-bars made under identical conditions as in the investment foundry. In reply to another question, the author enumerated the tramp elements which were generally troublesome. The 13 per cent. chrome steel, however, responded little to vacuum melting, presumably because of interference by tramp elements, and so the practice at his firm was to select virgin stock, after an exhaustive analysis to make sure that the material was pure. In this way a high quality could be ensured in the final product. Was there a reason for casting the material in bar form and not in shot form, and what were the merits or demerits of "shotted" alloys for remelting, another member asked? To this Mr. Taylor replied that some years ago serious difficulties had been encountered with Crown Max steel in shot form and, since that time, they had stopped making shot. Shotted alloys were particularly bad for remelting, especially HR Crown Max, for, when poured in water, it became brittle because of hydrogen pick-up. In answer to a question whether the stirring produced by high-frequency melting was beneficial, Mr. Taylor replied that generally it was so, but that violent agitation due to the use of very-high-frequency current was not so good.

S.-g. Iron Licensees

Seventh International Conference

Following similar conferences, begun in Brussels in 1951, and held successively in Atlantic City, Paris, Florence, Birmingham, and Essen, the Seventh International Conference of S.-g. Iron Producers took place in Brussels from September 25 to 27, 1958, under the presidency of Mr. F. Dickinson, manager of the development and research department, the Mond Nickel Company, Limited. Delegates to the conference numbered 175, representing some 13 European countries, America and Africa. The technical sessions were held in the *Salle d'Armes, Palais d'Egmont*. Twenty papers were presented and discussed on the following subjects: Treatment; founding and processing; special s.-g. irons; properties, testing and specifications, and applications. The technical discussions were followed by a showing of the Mond Nickel Company's new film, "Spheroidal-graphite Cast Iron."

The ladies, who accompanied the delegates, took part in a programme of sightseeing tours, which included visits to Ghent, Bruges, Laeken, Waterloo and the Chateau de Beersel. On the evening of September 25, the *Groupement Benelux des Fabricants de Fonte à Graphite Spheroidal*, under the presidency of Mr. Richard, welcomed the delegates and ladies at a cocktail party in the grounds of the *Exposition Internationale*. On the evening of September 26, the Mond Nickel Company were hosts at a banquet held at the Hotel Metropole, and the proceedings closed at midday on September 27, with cocktails in the Mirror Room, *Palais d'Egmont*.

Works Visit at Tilghman's

On October 8, a party of about 50 midland engineering executives were the guests of Tilghman's, Limited, of Broadheath, Altrincham, Cheshire. This tour was organized by Mr. C. Dodds of the Engineering Industries Association. Prior to a luncheon in Knutsford, Cheshire, presided over by Mr. J. Karle, the managing director of Tilghman's, the guests were welcomed by Mr. R. J. Richardson of R. J. Richardson & Sons, Limited, Birmingham, the midland area agents for Tilghman's. After lunch, a tour was undertaken through the machine and assembly shops of Tilghman's, who manufacture abrasive cleaning plants, dust-extractor equipment, and air compressors. The party was also shown around the associate company of George Richards & Company, Limited, whose range of machine tools manufactured include horizontal boring and facing machines, keyseating machines and crankpin machines, etc. The tour ended with tea, during which Mr. J. P. Howell, of the Birco Motor Cylinder Company, Limited, speaking on behalf of the guests, thanked Mr. Karle for a most instructive and interesting day.

Crucible-life Competition

In the competition for the longest-life crucible organized by the Morgan Crucible Company, Limited, the prize for the copper-base alloy section was won by Argus Foundry Company, Limited, Thornliebank, Glasgow. A Suprex crucible, a TPC 400, gave 226 heats of brazing metal, gunmetal, and phosphor-bronze. It was still good for additional melts. In the aluminium-alloy section, the prize was won by Sturla's Bronze Foundry Company, Limited, Waltham Cross, Herts., where, using a Suprex CC.150, they obtained 322 heats of LM.4. It appeared to the judges that a life of 400 heats could have been obtained.

Extension to Perry's Pressure-cast Foundry

This article describes the progress made in a period of seven years in the pressure-cast-plate department of G. Perry & Sons, Limited, Hall Lane, Leicester. To some extent the process has been mechanized and the operations of drying and casting have been segregated.

Seven years ago, G. Perry & Sons, Limited, wood and metal patternmakers of Leicester, employed one person on the pressure-cast process for making aluminium patternplates. To-day, a staff of 25 is employed. A modern section of the works, incorporating a light-alloy foundry, has recently been opened, and in this is installed the latest equipment to control, and economically produce, accurate pressure-cast plates. Considerable progress has resulted since the original attempts to make pressure-cast plates were made, and to-day, the weekly output of the works averages 20 sets of plates per week; some of these weighing up to 450 lb. per pair of (aluminium) cope-and-drag plates.

New Shop

The shop is spanned by an overhead travelling crane for approximately half its length, using a 3-ton Morris unit. This serves the bale-out melting furnaces and the large oven. It is used for placing moulds in and out of the oven and for turning over large moulds. The remaining part of the shop (Fig. 1) is served by a monorail crane.

The equipment in the new foundry section includes three gas-fired ovens, two oil-fired bale-out type furnaces, capable of melting 500 lb. of aluminium, and a hydraulically-operated press. Compressed-air is piped throughout the entire foundry and finishing shop.

FIG. 1.—*General view of Perry's new shop for producing pressure-cast patternplates. At the rear can be seen the section housing the melting furnaces, ovens, etc. In the foreground, are the individual work-benches with ancillary machinery on the left-hand side.*

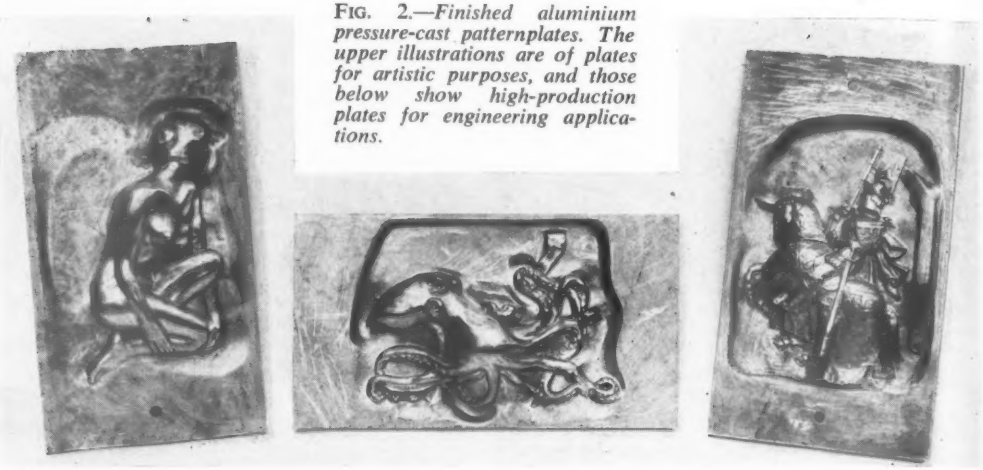
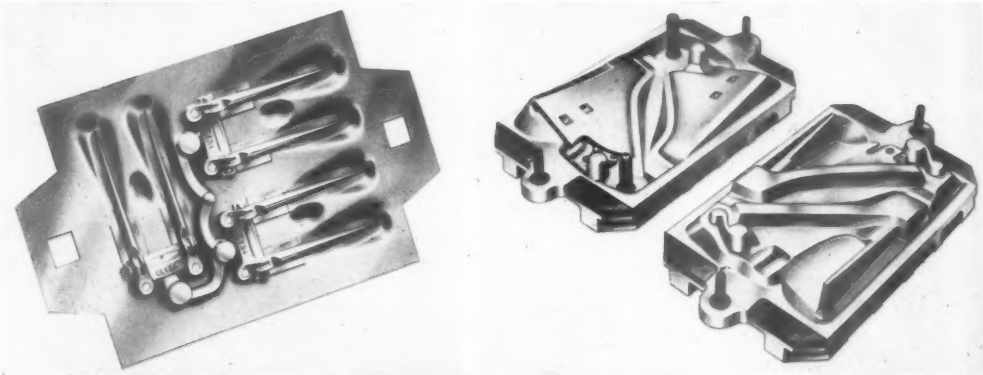


FIG. 2.—*Finished aluminium pressure-cast patternplates. The upper illustrations are of plates for artistic purposes, and those below show high-production plates for engineering applications.*



Process and Service

The pressure-cast-plate process is now carried out in an independent department of the firm. The process includes the making of the master patterns, checking, production of the actual plates, finishing (Fig. 3) and final setting up. Provision is made for the disposal of waste plaster (approximately four tons per week) and adequate fume- and dust-extraction from the working areas is arranged.

FIG. 3.—*Finishing section of the patternplate department, showing the checking of plates on a large surface table and individual handwork at the benches.*

Patternplate service given to the customer includes, if required, the designing of the plate layout and its suggested runner system, and this scheme is submitted to the customer for approval. Close liaison is maintained with each customer and in this respect an " outside " technical representative, having a knowledge of individual users and their specialist requirements, has proved most useful. Over a long period the department has served over 500 customers, including most of the leading firms in the foundry industry. One firm, for example, has purchased over 350 sets of plates during the last four years, and there are many who have purchased in excess of 200 sets in a period of three years.

Range

The range of plate sizes has been increased considerably over the years, and at the present time the foundry is able to produce plates of sizes up to and including 54 by 42 in., and during the next few weeks this arrangement will be extended to produce plates 6 ft. 10 in. long. Experience gained enables the company to produce accurate pressure-cast plates for both conventional moulding methods, and shell moulding. There is no limit to the shape and size of plates which may be produced within the normal range of frame sizes, and the types of equipment produced embrace patterns for ornamental and decorative work, through miscellaneous uses, to the high-production units employed in the automobile industry (Fig. 2). The pressure-cast department of the firm has already produced over 5,000 sets of aluminium plates to date. The field of customers is not by any means confined to the British Isles, and sales have become world-wide, including destinations as far apart as South America, India, Australia and Scandinavia.

Gravity-die-casting

Improved Method of Clamping Die-blocks

In many gravity-die-casting foundries, the most common method of clamping die-blocks together is to have a latch-type clamp or alternatively a cam-type clamp as illustrated in Fig. 1 (*a*). This type of clamp works very well when the die is new, but, with repeated closing and clamping of the blocks, the cam faces wear very quickly, also the latch has to be hammered into place and this very often results in the latch cracking or the lugs breaking off.

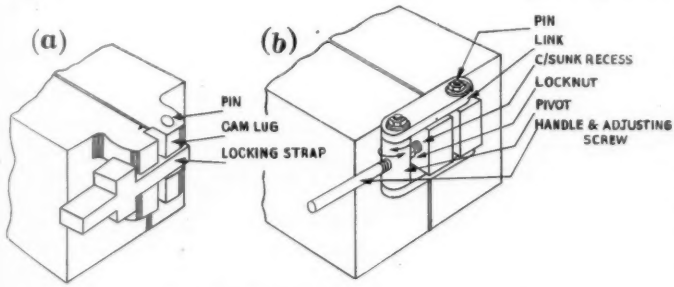


FIG. 1.—*Types of clamps for die-blocks:* (a) *orthodox cam type;* (b) *toggle type adopted as an improvement.* (*For the sake of clarity, die joints are shown with double lines although, of course, tight closure here is essential.*—EDITOR.)

Toggle Clamp

In order to improve on this method and to eliminate the hammering operation, a toggle type of locking device was developed. The clamp shown in Fig. 1 (*b*) works almost on the same principle as any of the many toggle clamps already on the market. The two die-blocks are first of all brought together and the clamp attached to the block at the rear is brought around over the lug on the other die block. The adjusting screw, which works in a pivot, is located in a recess in the lug; the handle is levered over and so locks the two die blocks securely together. All the components of the clamp can be standardized and therefore can be produced in quantity, whereas the two outside blocks on the locking strap of the cam type of clamp have to be individually machined to suit the cast cam faces of the lugs on each particular pair of blocks.

Comment

This method of clamping two die-blocks together has the advantage of being simple yet effective, die maintenance-costs are decreased as no hammering is required to operate the clamps, and subsequently there is no danger of cracking the die; any wear which may take place is taken up by simply altering the position of the adjusting screw.

New Blast-furnace Gasholder for Steelworks

Sixth A.B.P. Klonne type dry gasholder, completed for iron and steel works since the war by Ashmore, Benson, Pease & Company, has recently been put into commission. The holder, which has 3,000,000 cub. ft. capacity, incorporates an automatic system of lubrication designed to improve the distribution and reduce the consumption of grease and will be used to store blast-furnace gas.

The company has a further five in course of manufacture. Capacities have ranged from 1,000,000 to 5,000,000 cub. ft.

Equipment and Supplies

Blast-heater for Cupolas

An American line of hot-blast heaters for cupolas, developed by the Brown Fintube Company, of Elyria, Ohio (Fig. 1), an American heat-transfer concern, is reported to cut cupola coke-consumption from 20 to 30 per cent., while providing better metal for casting.

This system, it is stated, offers a number of advantages to the foundryman. Air is rapidly preheated to a uniform temperature in the thermal heater and then combined with the coke in the cupola, at a much lower cost than directly heating the cupola with metallurgical coke alone. The heaters are fired with gas, oil, or both, and have such high thermal-exchange efficiency that they eliminate the need for refractories.

The heater delivers hot-blast air almost instantaneously, producing air at temperatures from 200 to 650 deg. C. in quantities up to 10,000 cub. ft. per min. at the desired pressure in two or three minutes. The rapid heating results in worthwhile fuel savings. For example, in initial field tests, a foundry melting 33,000 tons per year reported a projected coke saving of over £11,000 per year, while one with a 10,000 tons annual capacity reported savings of the order of £3,000.

Brown thermal heaters incorporate the firm's basic design of heat-transfer equipment which has been in use throughout industry for 13 years. It is a fully-automatic "packaged" unit with heat-exchanger, burners, all controls, safety devices, interlocks and instrumentation ready for immediate installation.

FIG. 1.—*Installation of a Brown blast heater in conjunction with a cupola plant.*

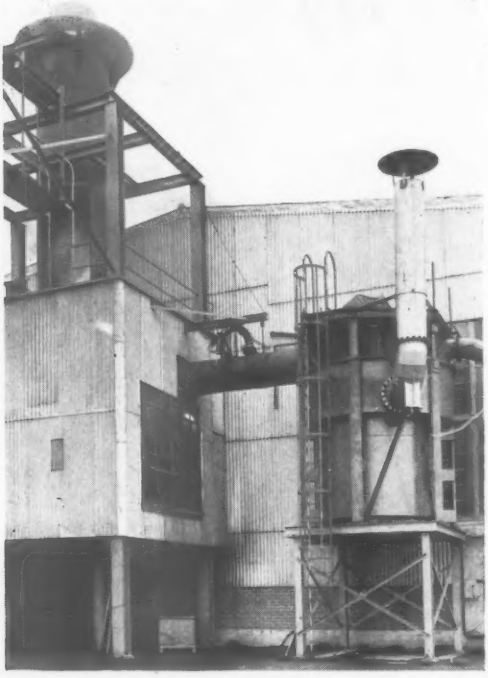


FIG. 2.—*Lightweight face-shield, incorporating a new type of headband, introduced by Parmelee (GB), Limited.*

The unit, being completely metallic (without refractory material), possesses an unusual method of a quick pick-up or turn-down for economical operation as applied to standard cupola practice. The heaters employ a counter-flow principle in which the products of combustion pass upward through a radiant-tube section, then reverse direction and flow down through an annular convection section which contains a number of small tubes finned on both the inside and outside. These finned combustion tubes provide, it is reported, from eight to ten times the surface-area of a plain bare tube. They permit more heat to be transferred per square foot at lower temperatures and sharply reduce the physical size required for heaters. The fins are contained in an outer shell with an expansion joint. Compact in size, any number of heaters can be interconnected in parallel and operated together to produce any needed total capacity. Furthermore, the heaters require only a minimum of insulation and can be relocated easily to meet plant rearrangements.

Face-shield

Parmelee (G.B.) Limited, 39 C & D, Bedford Avenue, Trading Estate, Slough, have introduced a lightweight face-shield (Fig. 2) with a headband eliminating the need for the usual overhead harness. This is more comfortable and provides the wearer with increased freedom of head movement. The headband is of flexible stainless-steel treated to resist corrosion and chemical action, with an inner washable Sorboprene cushion lining. The visor, made of clear cellulose acetate with a wide field of distortion-free vision, is shatterproof, and washable. It can be adjusted to any angle and locked instantly.

IN CONNECTION WITH the Glasgow railway electrification scheme, the Scottish Region of British Railways have placed a contract with Alexander Lindsay, Limited, Glasgow, for electric-lighting installation at Newton passenger station and yards, and a new power-operated signal-box.

Welding Cast Components for Nuclear-power Application *

By W. H. Rice

The complexity of shape of component parts for atomic-power plants has led to the casting industry becoming a major supplier. In addition, certain alloys can be produced economically only in cast form owing to their hot-short characteristics. Because of the rigid material requirements of the atomic-power programme, it is now routine practice to produce castings of a perfection that would have been considered impossible even three years ago.

At present the material predominantly used for nuclear pumping systems is stainless steel. The most prominent material is austenitic stainless ACI CF-8, although impellers and other auxiliary parts are frequently produced in martensitic chromium stainless CA-15. Other alloys used are CF-8M, CF-3, Ch-10 and CF-8C as well as various modified analyses of all of the foregoing.

The fact that small castings of simple shape are of greater soundness and quality than extremely complicated castings has led to the increased demand for cast/weldments. A typical example is a pump for a land-based nuclear installation. This volute consisted of two cast CF-8 stainless-steel halves to be welded together. The contour of the weld groove was cast on the edge to eliminate an undue removal of metal during machining of the finished groove.

The two pump halves were fitted and tack-welded together with a consumable insert fitted into the joint for an inert-gas backed heliarc root pass, and mounted on a welding positioner. The weld was then completed to Class 1 radiographic standards with the metallic inert-gas process using $\frac{1}{16}$-in. 308 stainless filler wire at 290 amp. The shielding gas for the MIG process consisted of argon containing 1 per cent. oxygen to produce a spray-type arc. A little pick-up work was necessary around corners with type 308-15 electrodes.

Composition *versus* Welding

As the chemical metallurgy of each type of steel is different, so is the physical metallurgy, which accounts for the differences in physical and chemical properties. As heat-treatment, forming, and mechanical characteristics of each alloy differ, so do the welding characteristics. In fact, very slight chemical alterations of a given alloy frequently exert a vast influence on its response to welding. For example in the case of a stainless steel (chrome 18 per cent., nickel 12 per cent. and molybdenum $2\frac{1}{2}$ per cent.), balanced chemically so as to be fully austenitic, use of small-diameter electrodes at quite low current settings, with very low interpass temperature, was necessary to prevent fusion-zone microfissuring. Use of stringer beads, skip welding and moderate peening was also required. The microstructure of another heat made to the same chemical specification contained about 6 per cent. ferrite owing to a slightly higher chromium and lower nickel balance. After welding the ferrite has been largely converted to sigma phase. The excellent weldability of this heat in comparison with the previous one is attributed to the ferrite content.

The temperature service conditions of an alloy must be considered carefully. Chromium carbide forms at temperatures between 427 and 649 deg. C. and precipitates out in grain boundaries leaving the metal adjacent to the boundaries depleted of chromium. This condition may render the steel susceptible to certain types of chemical attack along grain boundaries owing to an insufficient amount of chromium. This condition frequently exists in the base metal adjacent to raw welds and is commonly referred to as intergranular corrosion or weld decay. Chromium-carbide precipitation can be stopped after welding by solution heat-treatment at 1,093 deg. C. followed by water quenching, or by using a stabilized grade of stainless steel.

Stabilized grades contain either columbium or titanium, which react more readily with carbon than does chromium, leaving chromium dissolved in the base metal for protection against corrosion. Another possibility is the use of low-carbon grades of stainless steel. The carbon content of these grades, less than 0.03 per cent., is not sufficient to cause harmful carbide precipitation. Welding difficulties of the stabilized grades are increasing the popularity of the low-carbon grades.

Qualification of Welding Operators

Only highly skilled operators with many years experience are permitted to weld castings for the atomic-energy programme.

It is of the utmost importance that careful control of quality be exercised by the supervisory personnel at all times. A fast and common method of maintaining quality control is by visual inspection which requires the use of good lighting and magnification. Visual inspection should consist of examination prior to, during, and following welding operations.

Examination prior to welding consists of looking for defects in the base materials and assuring that scale, grease, dirt, paint, or other contaminants have been removed properly. Joints are washed with new or redistilled acetone or alcohol, followed by rinsing with distilled water and drying with lint-free cloths prior to welding. Inspection is made of fit-up and alignment of parts and joint edge preparation.

Inspection

During welding it is necessary to inspect each pass after it is deposited, for porosity, cracks, lack of fusion, slag, roughness, undercut, and the like. Any such defects must be removed by grinding with rubber or resin-bonded aluminium-oxide wheels or carbide burrs. The only grinding wheels

* Abstracted from a paper from the Metals Engineering Division of the American Society of Mechanical Engineers to the ASME/AWS (American Welding Society) Joint Metals Engineering Conference in St. Louis.

Welding Nuclear Components

that may be employed are new ones or ones which have been used previously only on the same type of material.

This is to avoid contamination by imbedding foreign particles in the base metal. For similar reasons all brushing of welds is done with stainless-steel brushes that have not been used previously on carbon steel. The root pass in many cases is the most important one, as a notch effect caused by incomplete fusion may lead to failure of the weldment or interfere with decontamination.

After welding, inspection should be made to determine dimensional accuracy, including warpage. The size, continuity, contour and distribution of welds should be in accordance with the requirements of the job. The appearance of the finished weld, such as spatter, regularity, roughness, and so on, in many cases provides a clue as to the quality of workmanship. Careful examination should be made for flaws such as cracks, porosity, unfilled craters, ends of welds and undercut. The use of dye or fluorescent penetrants is a valuable aid in discovering cracks or other defects associated with welding. Dye penetrant is normally used on the root bead, at each ½ in. of deposited weld metal, and on the completed weld.

It is necessary to conduct complete mechanical, metallographic and chemical tests of welds of each alloy produced in a given foundry. If satisfactory results are not obtained, the procedure must be revised and retested until optimum results are obtained. In addition, check tests are required periodically of qualified operators to assure that required quality of workmanship is being maintained. Likewise, any major change in procedure or process must be accompanied by appropriate tests in order to determine its suitability.

Acknowledgment

The author wishes to express his appreciation to the Electric Steel Foundry Company, Bingham Pump Company, Willamette Iron and Steel Company, Westinghouse Electric Corporation and E. I. Du Pont de Nemours for assistance in preparation and permission to present the information contained in this paper.

"Passing Off"—the Legal Aspect

By Lord Meston

It is a civil wrong to pass off one's goods or business as the goods or business of another. This takes the form of selling merchandise or carrying on business under such a name, mark, description or otherwise in such a manner as to mislead the public that the merchandise or business is that of another person. To establish a case of "passing off" proof of an intention to deceive is not essential. It is sufficient to prove that the practice complained of is of such a nature that it is likely in the ordinary course of business to deceive the public. Therefore it is not necessary to show that there is any likelihood of deception of the immediate purchasers. It is no defence for a person, who has been "passing off" someone else's goods as his own, to say that an observant person who made careful examination would not be misled. In considering whether deception is probable, account is to be taken not of the expert purchaser, but of the ordinary ignorant and unwary member of the public.

It is immaterial whether the false representation about the merchandise, *e.g.* castings, is made expressly in words or impliedly by the use or imitation of a mark, trade name, or get up with which the goods or business of another person are associated in the minds of the public.

Common Instances

There are several kinds of passing off. Some of the more common may be described as follows:—(1) The direct statement that the merchandise or foundry of A is that of B. (2) A more subtle type of deception by trading under a name so closely resembling another name as to mislead the public. For example, the Universal Life Assurance Society were granted an injunction to prevent a company subsequently incorporated from carrying on a business under the name of the Universal Life Assurance Association. (3) Where a person uses or imitates the trade name or trade description by which someone else's goods have become known to the public. A trade name means a name under which goods are made or sold by a certain person, and which by established usage has become known to the public as indicating that those goods are the goods of that person. It is not necessary for the injured person to show that he is himself known to the public by name. All that is necessary is to show that his goods have become known by the particular name or description in question as the goods of a particular manufacturer. Thus, the words "Yorkshire Relish" were held to have become known as meaning sauce of a particular manufacture, and the plaintiff in the action for "passing off" these goods was held entitled to succeed, although purchasers did not in fact know his name in connection with the sauce at all.

Descriptive Name

But a trade name must be distinguished from a merely descriptive name. The latter is also a name under which a product is sold, but which merely indicates the nature of the product, and not that it is the merchandise of any particular person.

Accordingly a person cannot be restrained from using some purely descriptive expression. Everyone has a right to the ordinary use of the English language. For example, a brewer who puts on his bottles a label with the words "nourishing stout" is not entitled to restrain another brewer from using the same or similar words on his labels. Again, there can be no restriction on the use of a word which merely describes the substance from which an article is manufactured. Thus the word "naphtha" cannot be monopolized by one soap-maker, but may be employed by anyone engaged in the trade.

Business Name

As for business names, a person may adopt any name for trading purposes, provided that it is not already appropriated. In the case of a company, it is provided that the Board of Trade may prohibit the registration of companies under names the Board disapproves of; and the Board of Trade has power to require a change of name if in fact a new company is allowed a name "too like" that of an old one. As a general rule any person may trade in his own name, or use it as part of his business name, provided he does so honestly. But the right to do so is not absolute. The question in each case is whether the use of the name is calculated to deceive the public unless precautions are taken.

In every case the element of confusion is essential. That is to say, the public must have been led to confuse the business or product of A with the business or product of B. The element of confusion necessitates comparison, and there must be a common field of activity in which both A and B are engaged. By way of example, we may refer to the actual case where A had acquired a very wide reputation as broadcaster of children's programmes under the fancy name of "Uncle Mac." On the other hand, B was engaged in producing and marketing puffed wheat under the same fancy name. It was held that as the famous broadcaster was not engaged in producing or marketing puffed wheat, there was no field of activity common to both parties. Therefore the producer and marketer of puffed wheat had not "passed off" the goods or business of the broadcaster of children's programmes.

Trade Mark

A fourth kind of "passing off" relates to a similar form of deception which may arise in connection with a "trade mark." This is any mark habitually attached by a trader to goods manufactured or sold by him in order to indicate that they are his merchandise, and by established usage known to the public as possessing that significance. The wrong of "passing off" is committed when a person sells goods with the trade mark of another or any deceptive imitation attached to the goods. It may be noted that trade-mark legislation has established a register of trade marks and provided for legal proceedings based on such registration. However, the remedy for "passing off" (which will be referred to later) is in addition to, and not in place of, any remedy which the proprietor of a registered trade mark may possess under the Trade Marks Act.

Again, to imitate the get-up or appearance of a person's goods so as to deceive the public counts as a very subtle type of "passing off." This may take the form of passing off inferior castings by circulating catalogues copied from those of another person.

A sixth instance which may be cited is the selling of second-hand goods as new goods manufactured by another person.

Remedies

In an action at law for "passing off," the remedies may be (*a*) an injunction restraining further passing off, (*b*) damages, or, alternatively, an account of profits, and (*c*) an order for the delivery up of the offending articles or for otherwise dealing with them. Where damages are recoverable they may include damages to the trade reputation of the injured party.

The above-mentioned remedies for "passing off" are in addition to, and not in place of, any remedies which may also exist in respect of infringement of the statutory rights of patentees, the proprietors of registered designs, or the proprietors of registered trade marks. It may happen that if registration has been impossible, or has been carelessly omitted, the above-mentioned common law remedies of "passing off" adequately protect a trader whose business is subjected to competition of an unfair character. In conclusion, there can be no action for "passing off" unless there is interference with another person's trade, either actual or potential.

Belgian Ironfoundry Statistics

Mr. P. de Keyser, writing in *La Fonderie Belge*, states that the Belgian ironfoundry industry now employs some 15,000 to 16,000 workpeople, spread over some 300 concerns, of which the monthly production varies from 25,000 to 30,000 *tonnes*. Some 39 per cent. of this amount is made in the Liège area. Referring to the statistics assembled by *Fabrimetal*—the Belgian employers' federation where Mr. de Keyser is the director of the foundry groups, it would appear that 68 per cent. have a monthly production of less than 100 *tonnes*, 16 per cent. from 100 to 199 *tonnes*, 9 per cent. between 200 and 499 *tonnes*, and 6 per cent. greater than 500 *tonnes*. During the period 1947 to 1949, the average production was 292,046 *tonnes*, in 1955, 298,593, in 1956, 345,698 and last year 321,609 *tonnes*.

Latest Foundry Statistics

Ironfounding.—On August 30 there were, according to statistics released by the Council of Ironfoundry Associations, 130,725 people engaged in making iron castings, of these 121,999 were males and 8,726 females. Compared with August 2, the total shows a decline of 336, but a comparison with August 31, 1957, reveals a decrease in personnel of 7,411.

Dust Exhaust from Fettling Benches

Examples of Calculation and Design

In a paper on "Foundry Dust Control"* presented recently by E. Bradley of the West and East Yorkshire branch of the Incorporated Plant Engineers, the subject is first considered in relation to air flow into hoods and velocity calculations are quoted for various designs. Thereafter, specific foundry applications are considered—shakeout, fettling bench, grinders, etc.—and the subject matter is concluded by sections dealing with ducting systems, dust separators, and fans. Among the examples quoted by the Author, that pertaining to the velocity calculations and design of fettling benches is reproduced in what follows:—

The application of effective dust-control to the hand fettling of castings on the fettling bench has in the past been a somewhat difficult problem. Hand fettling involves the use of small portable grinding wheels and pneumatic chisels, and the work to be dressed usually varies considerably in size and shape.

There are two types of exhausted fettling bench in general use, one is fitted with cross-flow, and the other with a down-flow system. As an example for required air-flow-volume computation with down-flow hopper exhaust, the following example is put forward:

Fettling bench top 4 ft. by 2 ft. 6 in. with grilled top 3 ft. by 1 ft. 6 in., air velocity through grille 250 ft. per min.

Let Q = volume in cub. ft. per min.; A = area of grille in sq. ft.; v = face velocity at grille in ft. per min., and V = velocity in hopper branch-pipe (ft. per min.).

Thus $Q = A \times v = 4.5 \times 250 = 1{,}125$ cub. ft. per min. Assume branch velocity as 4,200 ft. per min., then:

$$\text{Velocity head} = \left(\frac{V}{4000}\right)^2 = \left(\frac{4200}{4000}\right)^2 = 1.1 \text{ in. w.g.}$$

For resistance of hopper, take 0.5 velocity head, then: $1.5 \times 1.1 = 1.65$ in. w.g. for hopper

To this will be added the resistance of any further ducting where connected to a ducting system, or the resistance of a unit-type dust arrester where such is used.

Example in Design

In order to make clear much of his earlier expositions, the Author considers the application of dust-control system to a line of fettling benches. The general layout of the plant concerned comprises three fettling benches arranged for down-flow exhaust, similar to each bench having a grille top 3 ft. by 1 ft. 6 in. (as above).

Commencing with the bench furthest from the fan, and taking this as the "index" unit, from the earlier calculation, the following was obtained:—

Volume 1,125 cub. ft. per min., velocity 4,200 cub. ft. per min., velocity head 1.1-in. w.g.

Working on the given velocity and picking up the various branches, the main sizes up at 7-in. dia. between the index bench and bench No. 2; 10-in. dia. between No. 2 and No. 3 and 12-in. dia. beyond bench No. 3, rising 12 ft. to the fan and extraction unit (cyclone). The final volume is 3,375, say, 3,400 cub. ft. per min.—this will be the volume for fan duty.

For the purpose of this example, the ducting resistance may be taken as 45 diameters = one velocity head = 1.1 in. w.g.

Resistances

		Velocity Head
6 ft. of 7-in. dia. pipe plus one bend	$= \frac{25.7}{45} = 0.57$	
7 ft. of 10-in. dia. pipe	$= \frac{8.4}{45} = 0.187$	,,
8 ft. of 12-in. dia. pipe plus two bends	$= \frac{36}{45} = 0.8$	,,
Two junctions, branch to main, say,	0.4	,,
Resistance of cyclone, say	2.0	,,
Velocity head plus velocity-head loss at index hopper	1.5	
	5.457	,,

$5.457 \times 1.1 = 6$ in. w.g.

Thus, the fan duty will be 3,400 cub. ft. per min. against 6-in. w.g. and the fan will be of the paddle-blade type.

$$\text{Air h.p.} = \frac{5.2\ HQ}{33{,}000} = \frac{5.2 \times 6 \times 3400}{33{,}000} = 3.51,$$

where H = total head and
Q = volume.

$$\text{Fan h.p. (allowing 65 per cent. efficiency} = 3.51 \times \frac{100}{65} = 5.4$$

Allowing 65 per cent. efficiency for motor and drive,

$$5.4 \times \frac{100}{65} = 8.3, \text{ say nine h.p.}$$

Thus the fan duty will be 3,400 cub. ft. per min., 6-in. w.g. with a 9-h.p. motor.

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* The paper won for its Author the silver medal in the Alexander Duckham Memorial Awards, 1958.

LORD AUSTIN'S original office at Longbridge has been rebuilt into the new Engineering Centre of the Austin Motor Company Limited. The Centre was formally opened on October 6, Sir Leonard Lord presiding.

Congress Diary . . . By A. R. Parkes

Further Comment on Proceedings, Personalities and Events at the International Foundry Congress, 1958.

(*Continued from page 453*)

This week's section of the report on events in Brussels/Liège during the Congress period (September 28 to October 3) begins by commenting, in some detail, on the Brussels World Exhibition, and then continues with the technical sessions. For the majority of foundrymen—and especially those who could not participate personally—these latter constitute the major value to be derived from the proceedings. Although in necessarily a somewhat abbreviated form, an attempt has been made to pick out the salient features of the sessions attended, but it must be pointed out that these represent but a fraction of the whole technical content of the meetings. The account will be continued with general descriptions of the works visits, social functions and other gatherings of Congress week.

Last week's JOURNAL report of the proceedings of the International Foundry Congress held in Belgium from September 28 to October 3 dealt with the speeches at the formal opening ceremony in Brussels on the Monday, the reception and cocktail party which followed, and concluded by a mention that in the afternoon, delegates and ladies were free to tour the Brussels World Exhibition or "*l'Expo*" as it is locally known. This was one of several opportunities provided by the organizers during Congress week for both members and wives to visit the Brussels exhibition. A season ticket was provided. Despite the fact that the remainder of the Congress proceedings were centred in Liège, some 70 miles distant (and most participants were staying in Liège), many made good use of the coach transport "laid on" daily to the exhibition (a two-hour trip each way), or used the fast trains which almost halved the coach travelling time (Liège to Brussels), and for which concession fares were granted.

Secondary Attraction

Thus, it is correct to say that, for many foundrymen at the Congress, attendance and detailed tours of this really universal exhibition on the *grande* scale since that at Wembley in 1924 provided an enormous secondary attraction. It is interesting to draw the corollary that some such secondary attraction in conjunction with an international congress has an undeniable place. At the London Foundry Congress in 1955, the opportunity was missed of having a correlated exhibition but a wealth of sight-seeing trips to some extent repaired the deficiency. At the Düsseldorf Congress, in 1956, the GIFA Exhibition perhaps trebled the number of those who would otherwise have travelled to Germany. Then again, the Stockholm Congress last year offered to many their first opportunity of a visit to Scandinavia, and of experiencing something of the traditional hospitality of the area as well as inspecting the industries of those countries, and thus attendance was quite good. The moral of these remarks is left to those who organize future congresses, and particularly attention is directed to the note, appearing on page 487 of this issue, about next year's congress to be held in Spain.

"Proud to be British"

As the Brussels "*Expo*" (which, by the way closes at the end of this week, after being open for six months) figured so largely in the activities of Congress participants, a few words about its significance may not be out of place, though, of course, any comprehensive review would be impossible in the space available. Here, on a site of 490 acres, sufficient of the different facets of everyday life—home, industry, commerce, the arts, ideology, science and education—of each of the 50-odd nations and organizations having stand space are presented in bewildering diversification, in addition to amusement centres, and to cover the whole ground would be a Herculean task. Nevertheless, each major country has its own pavilion at the "*Expo*" and here it is that comparison one with another is inevitable. Thus, the writer takes pride in recording the universal verdict that, for once (and it is a pity that proviso has to creep in) the UK pavilion stands out as being superior. This is being said the world over by Americans, Far East and Middle East potentates, men from Alaska to the Caribbean regardless of personal nationality, and it certainly makes good hearing. Because, what does it mean? It means that in this era of peace-treaty groupings, free-trade areas, east/west power politics, possible movement away from the Commonwealth, this welter of unrest stemming from a seeking for better ways of living, the British way of life is expounded as a shining example, and countless ambassadors have been enlisted at Brussels to extol its virtues.

Objective Fulfilled

The major objective of the Exhibition was to display each country's background and creative forces

which have led to the developments within that country in the last fifty years. Nowhere—again by universal acclamation—is that better done than in the UK pavilions and ancillary sections—yes, right down to the replicas of English "pubs"! Many countries have seen fit to produce exotic and sometimes erotic displays; in some it is difficult to find an over-riding theme, in others the fantastic shapes representing perhaps modern art or building in the "current idiom" defy interpretation by the ordinary mortal and thus confuse him. (One foundryman, seeing some cast-bronze exhibits, was heard to mutter that he thought they were the result of metal running amok from a broken pot! Many others deplored that good metal should be employed to such grotesque purpose).

The UK section is in complete contrast. There is, in the historical section, an interpretation conveyed by relics, pictures, letterpress and models, first of our antecedents and of "milestones" of progress where the world has benefited from the achievements of English-speaking peoples. Then, in the industrial pavilion, are set out countless examples, well supported by documentary evidence, of where Britain has been first in the field of development and still holds the lead. Here, castings too (and all naturally of superlative quality) play their part, from the one-piece locomotive steel bogie-frame to components for a sewing machine. It might be thought that so much "blowing of one's own trumpet" might be irritating to the non-British national, yet in fact, there is no blowing of trumpets—the whole impression is subtly conveyed so that it becomes an inescapable conclusion reached by tourists for themselves. The warmest congratulations are due from each one of us to those responsible for so outstanding an "exposition" of the UK way of life. To see these stands indeed makes one feel proud to be British.

It should not be construed from the above remarks that the other pavilions are not in their own way excellent. The castings shown in the Metallurgical Pavilion, as illustrated in last week's JOURNAL, are of excellent quality and workmanship and well typify foundry developments in many countries. Displays of castings as, for example, in carillons of bells, in gigantic bladed rotors for hydro-electric schemes, and as parts of agricultural machinery, etc., are well up to UK standard and show that foundrymen everywhere have their importance recognized in the industrial set-up. Only in the realm of art castings is the quality in some doubt, at least as far as the writer is concerned, though the foundry practice *per se* embodied in the production of such "works" is indubitably of a very high order.

General Programme

For the majority of Congress delegates, the Tuesday and Thursday at Liège were spent at the technical sessions (about which more later) lasting from 9 a.m. to late afternoon. In all, some 37 papers were presented, including 13 exchange papers from constituent countries of the International Committee. In general, each speaker was given 15 to 20 minutes in which to introduce his paper to the audience and 10 to 15 minutes were provided for discussion. These times, however, proved fairly flexible, as was the lunch-time period, it being discovered at the last moment that the seating accommodation for 350 reserved in the restaurant at the *Palais des Congrès* was insufficient to cope with the members and ladies who turned up. A second sitting for luncheon had to be hurriedly arranged, but as the first took sometimes up to two hours to be served, some dislocation of programme resulted. As will be reported later, on the whole the technical sessions were well attended, UK delegates took a quite strong part in the discussions (in addition to presenting this country's contribution of four papers), and on the assessment of the technical content alone, the Congress could be assessed an unqualified success.

TECHNICAL SESSIONS

For the majority of the participants in the International Foundry Congress, the programme was resumed in earnest on Tuesday morning at the *Palais des Congrès* in Liège where from 9 a.m. to 4.30 p.m. (apart from a long break for luncheon), there were two simultaneous sessions for the presentation of technical papers. Thus, in lecture room No. 1, papers* by the authors: Scholz, Blanc, Marincek & Feichtinger, Patterson, De Sy & Van Eeghem, Flinn, Abcouwer, Trenckle and Namur were given in outline and discussed, about 15 to 20 minutes being allotted for the presentation in outline of the paper and 10 to 15 minutes for any discussion. In lecture room No. 2, papers by the following authors: Perry, Flemings & Taylor, Eminger & Kletecka, van Ewijk, Meier, Waeles, Villner, Thury, Emley and Hudson, Wood & Gregg, were given similar treatment. In each case, the president's table was occupied by a panel drawn from the various countries' official delegates to the Congress, acting in support of the chairman. Speakers walked to the rostrum to make their contributions and this, together with what was on the whole excellent instantaneous translation service through earphones, added much to the seriousness and general understanding of the deliberations. It would have been an improvement, however, if the name of every speaker had been announced to the assembly.

The writer divided his attendance during the technical sessions on that day in lecture theatre No. 1 (morning) at which about 200 to 300 were present, and theatre No. 2 in the afternoon (150 present). Discussion contributions on the whole were meagre by UK standards, yet it is difficult to see how more contributions could be secured in future procedure. Certainly, the great number and length of the papers as a whole had imposed an enormous task on the Belgian organizers to

* The majority of papers presented were abstracted in last week's issue of the JOURNAL and the remainder are so treated in pages 484-487 of this issue.

[This and succeeding illustrations in this article are reproduced by courtesy of *Photo Congrès-Hersleven JRP Anvers.*

Some of the past-presidents and vice-presidents attending one of the committee meetings during the course of the Congress. From left to right they are: Mr. A. Dacco (Italy); Mr. A. Brizon (France); Mr. Max Vuilleumier (Switzerland); Dr. A. B. Everest (UK) and Mr. F. W. E. Spies (Netherlands).

get them printed and bound in time for the Congress opening. Yet one wonders if the dispatch of separate unbound copies of papers to those participants desiring them—which presumably could have been effected some weeks earlier—would not have been conducive to better discussions. On the whole, the papers were involved scientific treatises expressing a method of investigation, experimental details, collection and expression of data and comments on interpretation of results. With this type, it is difficult to contribute much by way of "off the cuff" observations at a moment's notice. And yet, as reported after the 1956 and 1957 Congresses, too much freedom given to would-be discussion contributors can result almost in their setting up opposition "camps" or occupying the rostrum for long periods at the expense of their fellow contributors.

A Compromise

As usual, a compromise is desirable, and for this, the writer puts forward the idea that (*a*) "International" papers should be available two months before a congress to those intending participants requesting them; (*b*) that priority in discussion should be given to contributions submitted to the organizers in writing before the session (but these should be subject to strict editing); (*c*) if possible, the author should be given the opportunity to prepare a short reply to questions arising in this way, and (*d*) the chairman should be given —and should *exercise resolutely*—power to curtail overlong contributions or yet call upon persons in the audience to stimulate discussion. It should be well understood that, very often, a paper which is not discussed remains but a postulation—in other words, the work needs approbation or comment of some sort from experts of similar standing to the author really to give it the seal of authenticity.

Points from Discussions

Notwithstanding these comments, many excellent papers were presented at Liège and it is confidently expected that correspondence will be freely entered into between individual founders who may need further guidance and the various authors.* In addition, it is understood that tape-recordings were made of the proceedings, though it has not yet been made clear to what extent publicity will be accorded to discussion contributions. The following miscellaneous statements are indicative of the tenor of such discussion contributions as were made at the sessions the writer personally attended.

Speaking of research teams, Mr. G. Blanc, director of research, *Association Technique de Fonderie, Française,* agreed with a questioner that there is an optimum number of workers which must not be exceeded for getting the best combination of personal initiative and collaboration on any research project, but he declined to name any definite number.

A valuable feature of the paper by Marincek and Feichtinger on gases in cast iron was their agreement that there are still limitations in securing absolute accuracy in gas analysis. They explained the difficulty of storing specimens and commented on the degree of reproducibility of the analyses method used—which took 6 min. and consisted of an estimation made on a bath sample cast in a copper mould. A speaker here said it was important to know what was wanted from gas-analysis results and then to choose sampling and analysis techniques accordingly. Another well-known research head said he thought the separation of gas evolved during solidification would be most interesting, as would be knowledge of gas adsorption into the surfaces of samples. Founders wishing to have results from the gas analysis of their samples should be warned that the taking of the sample was all-important, another speaker added, as feeder-heads from castings were useless as samples since they invariably contained inclusions. He thought also that bath sampling was in some degree suspect

* Space in the correspondence columns of this JOURNAL is offered for any founders who wish to bring forward points for the attention of the Authors of papers and every endeavour will be made to secure replies.—EDITOR.

General view of part of the audience at one of the technical sessions in the Palais des Congrès.

owing to heterogeneity of the bath. Yet a further contribution to this discussion was to the effect that vitreous enamellers stood to gain most from gas-analysis research on cast iron as it could indicate, for example, the effect of storage of castings on the surface gas-content.

Discussing Patterson's paper—on the effect of inoculants on the "degree of normality" of an iron—Dr. Marincek added data about complex inoculants, Si/Al/Ca type, saying that only the calcium content was potent. The author agreed, but said the silicon content was still important because of its effect on the melting point of such materials. It appears that there is an optimum temperature above the liquidus at which inoculation of cast iron proceeds most favourably.

Manganese-containing Austenitic Irons

In Professor De Sy's absence, due to attendance at another session, the paper he jointly contributed on non-magnetic Ni/Cu/Mn cast irons was presented by a colleague. It contained an account of partial success which had followed attempts to substitute increasing manganese in non-magnetic irons. One speaker, referring to personal experience some 25 years' ago, said the main difficulty with such substitution was increased section sensitivity, that is, the liability to complex-carbide precipitation in manganese/austenitic irons of thin section, and the authors confirmed that this was borne out by the results they had found.

During the afternoon sessions, the paper about the new aluminium casting-alloy (Al/Zn/Si/Mg) from Dr. W. Thury, of Austria, created much interest, as did the long contribution from Dr. E. F. Emley (UK). The latter was truly exhaustive, but the material was of eminently practical interest, as showing a number of new applications for the metal open for exploitation by founders and it was clearly well appreciated. Discussion contributions here brought a number of suggestions which Dr. Emley thought worth pursuing; among them was the idea of spraying magnesium castings with aluminium to increase corrosion resistance—with the further notion that the aluminium coat could subsequently be anodized.

Magnesium/Silver Alloys

Amplifying his paper in response to a question, the author gave some interesting information on a new range of magnesium alloys (MSR) containing silver. Here, a table was illustrated indicating that the effectiveness of rare-earth additions to Mg alloys was much enhanced by the presence of small percentages of silver. Such alloys then gave, Dr. Emley said, minimum values of 10 to 11 tons per sq. in. proof stress; 15 tons per sq. in tensile and from two to four per cent. elongation. Additionally, he showed a slide of properties found (by R. J. M. Payne and M. Bailey of J. Stone & Company) in an actual casting made in the alloy described, the results being taken in the solution-treated condition. Summing up, Dr. Emley described the metal developed as a good alloy for casting purposes, having fair long-term creep and good high-temperature resisting properties, but said it might be somewhat expensive; the rare-earth additions were of the fractionated type, he declared.

The contribution by Hudson, Wood & Gregg (from the UK) on "Properties of Copper-base Alloy Castings" was the final paper given at this session (it was presented by Mr. Wood). This paper really reports that the qualities of an alloy for producing a good sound casting are but rarely indicated by test-bar results and goes on to show how actual casting properties—as shown by stepped-bar

samples and cut-up castings—could be improved by alloy additions, mainly to gunmetals. Discussion contributors seemed inclined to agree about casting/test-bar relationships, but disinclined to cut up more castings for test; the efficiency of feeding practice could make or mar any empirical strength results for an alloy, it was stated. A questioner (from Japan) asked how to prevent segregation in very-high-lead gunmetals (which, he claimed, were being used, with up to 25 per cent. Pb). The author thought such alloys were but little used, saying by far the greater percentage of leaded gunmetals being cast was of the 5 per cent. type; 10 to 15 per cent. Pb made the alloy very difficult to handle due to liquation problems.

Mr. G. Blanc said it was now generally recognized that nickel-containing Cu-base alloys were better if melted under oxidizing conditions—in contrast to beliefs held a few years ago. Mr. Grant agreed, but thought that the leaded variety might be more uniform if melted under reducing conditions. Another speaker asked why pressure testing of castings to destruction had not been employed and a contributor from the UK asked what were the possibilities of varying pouring temperature and cooling a gunmetal casting quicker—presumably by faster heat withdrawal from the mould. To both speakers Mr. Grant declared there was no lack of scope for further work. Cooling rates, he added, might prove of very great importance, but it would have to be remembered that some alloys, for example the tin/nickel type, might have age-hardening tendencies.

Mr. A. Pirson, secretary of the Congress, and head of the Congress information bureau, which consisted of a veritable army of willing helpers who placed themselves at the disposal of delegates during the whole period.

THURSDAY'S TECHNICAL SESSIONS

The technical sessions of the Congress were resumed at 9 a.m. on Thursday, October 2; this time they were spread over three lecture halls in the morning and two in the afternoon. Thus, in hall No. 1 papers by Coussement, van Bleyenberghe, Karamara, Wittmoser, Schneider, Szreniawski, Taylor and Mahabale were presented, and in hall No. 2 those by Imberty, Sims & Briggs, Ney, Snelson, Ohira, Sochor, Goenaga, and Longaretti & Ponsotti. In the third hall was held a special session to consider a series of papers prepared by the Liège section of the Belgian Foundrymen's Technical Association. These were: "Metal Pressures exerted on Mould Walls and Cores" by R. Namur; "Metallic Chaplets," by F. Kinet and "Hot- and Cold-strength of Moulding and Core Sands and Chaplets" by R. Collette, F. Gaty and R. Namur.

(*To be continued*)

Mr. R. Doat, president of the Association Technique de Fonderie, *addressing one of the meetings. (Mr. Doat is director and general manager of the Conduites d'Eau concern.)*

Next Year's Congress

Provisional Arrangements for Madrid

The invitation of Spanish founders to hold the 26th International Foundry Congress in Spain in 1959, has been gratefully accepted by the International Committee of Foundry Associations. It will take place in Madrid from October 4 to 10, and will be organized by the *Instituto del Hierro y del Acero* (the Spanish Iron and Steel Institute) in conjunction also with the fourth general meeting of the Spanish Higher Council for Scientific Research. The provisional programme includes the usual exchange papers from participating countries and a number of independent contributions and scientific reports. There will be the usual formal opening and closing ceremonies and a special feature will be made of the inauguration of new premises and equipment of the Spanish Iron and Steel Institute in the University City. Interspersed with the programme will be meetings of the International Foundry Committees, there will also be civic receptions, works visits, social functions, and as usual a special programme for the ladies. Two post-congress tours of both technical and tourist interest are being arranged, one to the North of Spain taking in Asturias, Santander, Vizcaya and Guipuzcoa, and the second of the South and Levant (Seville, Valencia and Barcelona). Those who may wish to participate should register with the *Instituto del Hierro y del Acero*, Villanueva 13, Madrid, and with their local foundry institute.

International Foundry Technology

Further Synopses and Extracts from Papers presented at the Belgian Congress

(*Continued from page* 416)

The following eight summaries, together with the 29 given in the October 2 issue of the JOURNAL, complete the series of synopses and extracts of the 37 papers presented at the International Foundry Congress held recently in Liège.

Magnetic Method for Controlling Casting Condition and Quality

By A. Karamara

The Author is attached to the Foundry Institute, Crakow, Poland.

This work includes the fundamentals and the practical implications regarding the magnetic investigation of castings. The experimental results obtained by several investigators, and the practical application of the method which has been possible so far, are summarized shortly. The special difficulties which must be overcome during the investigation of the magnetic properties of grey cast-iron, and also the great advantages which can be achieved by application of the method, are indicated in detail. In addition, the methods of measurement employed in the earlier work are described. The experimental portion of the work includes selected results of magnetic investigations on internal stresses, and on the reversible and irreversible processes which occur during tensile and compression tests, and of the structures of test-pieces in grey iron.

In the course of these investigations it has been established that:—(1) The maximum permeability, the residual magnetism, and the irreversible portion of the magnetic work done, are clearly influenced by the residual stresses as well as by the exterior loading; (2) clear quantitative relations exist between the stresses and the magnetic properties of the test-pieces, and (3) alteration of the structure of grey cast-iron effects a clear alteration in initial permeability and coercive force.

Blind-side Feeders, with Exothermic Sleeves, in the Steel Foundry

By E. Ney

The Author is a technologist attached to Electro Steelworks ARBED, Dommeldange.

This paper reports an investigation of exothermic blind-side feeder-heads, whose application in steelfoundry moulding is still little known. The exothermic feeder advocated by the author is in a cylindrospherical form, the height of the cylinder being equal to its diameter. Only the cylindrical portion of the feeder is surrounded by exothermic material. Thermal analysis of the operation of the exothermic blind-side feeder shows that the heating of the steel content in the blind feeder is practically nil, but that the unquestionably positive effect of exothermic coating is attributable to reheating of the wall of the feeder head. In addition, comparative tests have demonstrated that the application of exothermic blind-side feeders enables economies in the order of 40 per cent. in the weight of blind feeders to be realized. In these tests the Author develops a formula for calculating the dimensions of blind-side feeders.

A second series of tests carried out on castings fed simultaneously by a gravity-head and blind-side feeder reveals the field of practical application of blind-side feeders. In addition, the cross-sectional dimensions of the neck connecting the feeder to the casting have been studied in relation to the diameter of the feeder and the length of the neck. An experimentally established diagram permits easy reading of these dimensions. The distance of feeding from blind-side feeders in the vertical direction upwards has been determined for the case of a cylindrical casting. Finally, the application of blind-side feeders is described for typical sections in practice and the results obtained are interpreted in the light of recent methods of calculating feeder dimensions.

Thanks are due to Mr. Robert Langers, director of the Aciéries Electriques ARBED at Dommeldange who has kindly authorized the carrying out of the work relating to this paper, as well as Mr. Albert Hencks, chief engineer, who has favoured the Author with his invaluable advice.

Technical Relations between Foundrymen and Designers

By M. Imberty

The Author is in charge of the technical section of Compagnie Electro-Mécanique, Paris.

Many investigations and experiences have demonstrated the fundamental importance of the technical aspect of the relations between foundrymen and designers, in order to achieve the best and most economical organization. To satisfy the

needs arising from this co-operation, the organization of contacts, and channels of communication on the basis of foundry and engineering establishments does not suffice; it is essential to envisage it also on the basis of the professions.

Starting from a rational process of conception and realization of a casting, broken down into phases, this study formulates the type and scope of information required for technical co-operation between foundrymen and designers. It shows the value of developing technical documentation and direct contacts between foundry technicians and designers. In the course of setting out recent French achievements in these fields, it proposes a programme for the development of technical information for the foundryman and the designer. It brings out the importance of the contribution made by the foundry technicians who are alone able to formulate, co-ordinate, and classify the laws and rules which can be used by designers, and to render possible their judicious application in developing the design of the casting.

Investigation of Basic Refractory Materials for Cupola Plant

By B. Sochor

The Author is attached to the State Research Institute for Materials and Technology at Prague, Czechoslovakia, foundry department, Brno.

In this investigation, the basic melting procedure was studied in cold-blast cupolas from the point of view of the basic refractory materials (bricks and ramming materials). The object of the work was principally to evaluate selected types of available basic refractory materials under comparable conditions of basic operation. For this purpose, experimental melts were carried out in a cupola lined to 500 mm. (20-in. dia.) in which all operational factors were kept as constant as possible, with the exception of the lining and the melting charge. All basic refractory materials currently used in foundries were studied, including high-quality magnesite, chemically-bonded chrome-magnesite and three types of periclase-forsterite ramming materials (with the exception of dolomite). The following conclusions were established: (1) Both for refractory and metallurgical reasons, magnesite LID showed itself to be the best of the basic refractory materials studied, which were:—Magnesite LID; chemically-bonded chrome-magnesite LIC; periclase-forsterite SMH; periclase-forsterite VUHK UK; periclase-forsterite VZKG magnesite clay ramming materials; periclase-forsterite-clay ramming materials, and pure magnesite ramming materials. The use of chrome-magnesite and periclase-forsterite resulted in no advantages. (2) An answer was provided to the question whether the production of new refractory basic materials was necessary. The best results are obtained with the materials currently produced. (3) All the tested refractory materials resisted, without deterioration, the sharp temperature changes, and the effects of steam arising from dropping the cupola bottom and quenching the drop-coke. Spalling of the bricks was not observed. (4) Chemically-bonded bricks completely stood the test. (5) The basic ramming materials also withstood the test. The best results were achieved with magnesite mixture. The magnesite or periclase-forsterite clay mixture was very strongly attacked by basic slags. (6) In practice, the basic linings could be satisfactorily patched with corresponding materials. The patching materials were less resistant to slags than the linings. (7) The consumption of basic refractory materials calculated per unit weight of iron melted is clearly lower than the consumption of acid materials (2 to 3 lb. per 100 lb. of cast iron). Obviously the consumption is determined by several cupola operational-factors (type and size of furnace, quality of metal melted, blast quantity and blast pressure, etc.), but at the highest it is the same as with acid materials. (8) The consumption of basic ramming materials was definitely higher than that of the refractory bricks at a single composition. (9) The consumption of the basic lining depended on slag basicity. Lower basicity caused high wear, medium basicity the least wear, high basicity caused again high consumption of the refractory materials. For the melting conditions employed, the minimum consumption occurred at a basicity which corresponded to a flux addition of 5 per cent. limestone with 0.5 per cent. fluorspar. (10) As has already been found in many other fields of works operation, the consumption of basic cupola-lining materials seems to depend more upon the operating conditions than upon variations in quality of the refractories. (11) The course of basic melting is indicated by the basicity of the slags; with increasing basicity the difficulties and interruptions steadily increase. (12) The metallurgical and technological results studied at the same time confirm the already established great advantages of the basic melting process. (13) From the economic considerations, which are especially influenced by favourable prices for the refractory materials studied, it was established that the basic cupola operation showed a saving even with a substitution of 25 per cent. of the pig-iron with steel scrap.

Pressures Exerted on Mould Walls and Cores during Pouring

By R. Namur

The Author is technologist and metallurgist, *Fabrique Nationale d'Armes de Guerre, Herstal, Belgium.*

Calculation of the Impingement Forces

By applying Pascal's principle, the metal pressure-head should be increased by the height of the drop of metal through the pouring basin measured from the upper level of the metal in the pouring basin to the upper level of the sprue (formula 8).

Calculation of the Lifting Forces on the cope

Consider two groups of possible ceiling surfaces (horizontal projections of actual surfaces) according to whether their distance from the metal level in the pouring basin ($hi + he$) is greater or less than the height of the sprues having the least drop (H). (*a*) $hi + he \leq H$: application of Pascal's principle

to the pressure-head hi + he (formula 7). Add the sum of the thrusts transmitted by all the cores *via* prints or chaplets (thrusts calculated according to the third paragraph below). Note that included in the ceiling surfaces of this type are those associated with blind feeders and with horizontal feeders moulded on the joint line for bottom pouring. These surfaces are not absolutely negligible for the calculation of the lifting thrusts because they correspond to a considerable hi, perhaps even approximating to H. (*b*) hi + he $\leq$ H: calculating by the "safety-valve" method (formula 12). In this case, it is necessary to add only the thrusts transmitted by the cores or portions of cores situated below the gating level of the sprue considered. Note: The calculation of lateral forces can be carried out in the same way as for lifting forces but considering in this case the vertical projections of the surface of the casting.

Calculation of the lifting thrusts on cores: two cases

(1) Core situated below the gating level of the deepest sprue; thrust calculable by Archimedes' principle; (2) other cores: thrust calculated by the method of total pressure. Note: The safety of the method of calculation proposed is such that no other safety factor need be introduced. In particular, there is no need to consider the surfaces due to flash. If exceptionally thick or extensive flash is observed, the solution is to pay attention to the moulding conditions (including patterns) and to closing (including bolting and cramping) and not to work out the resultant lifting forces. For exact calculation, one can even take account of the actual weight of the sand in calculating the loads which will oppose the forces developed during pouring; this involves the utilization in the formulae of a fictitious density.

$$\delta^1 = \delta \text{ metal} - \delta \text{ sand} = \delta \text{ metal} - 1.5.$$

Moulding Material and Casting Surface

By P. Schneider

The Author is attached to the *Verein Deutscher Giessereifachleute* (German Foundrymen's Technical Association), Düsseldorf, Germany.

This investigation demonstrates that it is possible to determine reliably the surface roughness of the casting by means of a simple pneumatic instrument. The casting surface is defined as an integration of roughness whose individual values lie within a stated range, so that the results are suitable for statistical analysis. The results and their consideration show that the effect of all the factors can be explained by reference to the strength of the surface tensional forces on the liquid metal. To clarify any further work on casting surface, it is essential to differentiate clearly between penetration and roughness.

The results may be summarized as follows. A linear relationship exists between the gas permeability of the moulding sand employed and the surface roughness of the casting produced from it. This relationship holds even for different types of preparation of moulding sand. The cast-surface quality is improved with increasing milling time and hardness of ramming in synthetic sands. The linear relationship between permeability and surface roughness holds only for those moulding sands which are compacted at the same range of moisture content. Sands containing much more than optimum moisture contents lead to very rough castings. Casting surface roughness is markedly decreased by such additions as coal-dust and pelleted pitch. The roughness value is dependent on casting temperature, this effect being established during studies on the aluminium alloy G-Al Si 12 (C = LM6) and pure synthetic sands. The casting surface roughness in this case rose to a maximum with increasing casting temperature and then fell again. The marked reduction of surface tension brought about in cast iron by additions of sulphur led to a clear increase in surface roughness. At lower surface tension values the effect of hardness of ramming on roughness became less.

Graphite Formation in Iron/Carbon Alloys

By A. Wittmoser

(Lecturer for Foundry Technique, University of Technology, Aachen, Germany.)

The consideration of graphite formation should not relate only to the case of cast-iron, but should embrace all iron/carbon cast alloys. Appraisal of all the structures occurring in this alloy group shows that, fundamentally, two types of graphite predominate; graphite flakes, and spherical graphite (spheroidized too). The occurrence of the stated graphite forms is thus in no way tied to one or another material group in the iron/carbon cast alloys. For the consideration of the mechanism of graphite formation not only is the graphite form, as such, of importance, but also the location of the graphite particles in the metallic matrix. By the combination of these two characteristics five types can be evolved, into which all observed structures can be classified.

Close consideration of the mechanisms of formation, which probably control the individual types of graphite, shows a close connection between graphite type and the corresponding process of origination. A detailed examination of current knowledge on graphite formation by decomposition of ledeburite shows that the same mechanism holds for all iron/carbon alloys irrespective of the graphite type. The general marked similarity between this process of formation, and that of the precipitation of spheroidal-graphite from the solid solution supersaturated in carbon, renders it possible to admit only the two following possibilities for formation of graphite in all iron/carbon cast alloys: (*a*) Graphite precipitation in the liquid phase (melt), and (*b*) graphite precipitation in the solid phase (solid solution).

There is an additional point in the development of a model explanation, due to the fact that, in practice, both possible modes of graphite formation are effective in the crystallization of iron/

carbon cast alloys. However, there exists a clear connection between the mechanism of formation and the type of graphite in that the flake type originates mainly in the liquid phase (melt); the compacted to spheroidal types in the solid phase (solid solution). The result of this conclusion, however, is that in future the problem must be posed in a different way; it remains to be made clear how far recognized alterations in the chemical and physical characteristics of the melt favour one or other of the mechanisms of formation.

Effect of the Metal Stream on the Surface of the Sand Mould

By Prof. J. Szreniawski

The Author is attached to the Institute of Technology, Lodz, Poland.

This study comprises the investigation of the effect of the stream of metal on the sand mould during its filling, and the solidification of the metal up to the point of formation of a solid skin.

Three types of flow which destroy the mould surface are recognized:—the impact stream, the turbulent stream and the jet stream. A method is worked out by the aid of which the surface endurance of the mould sand or core sand being attacked by the metal stream can be studied. The definition of the endurance of the mould surface and its expression is given as well as the type of expression. The progress of the phenomena caused on the mould-surface layers by the metal stream was photographed.

On the basis of investigations carried out in experimental moulds, it was established that the evaluation of mould and core sands which is normally made in technological investigations at the working temperature by the known AFS and similar methods, is not satisfactory, and does not indicate the surface endurance under the various types of metal flow. The technological properties described do not embrace the factors which decisively influence the course of the physico-chemical phenomena occurring on the mould surface. The endurance of the mould surface under the influence of the metal stream can, however, be defined, and the investigations carried out in this work can be directly connected with the phenomena proceeding in the mould-surface layers. On the basis of the experiments carried through, the bases for practice were worked out. The conclusions were drawn from the original investigations of the Author himself.

Book Review

Giesserei-Lexikon (Foundry Dictionary), in German. Edited by A. Schulenburg and published by Fachverlag Schiele und Schon, GmbH, 10, Boppstrasse, Berlin, S.W.29; price, until November 15, D.M.48 and thereafter D.M.58.

Whilst the word *Lexikon* has been translated "dictionary," a truer interpretation would be encyclopædia, because each word is given anything from a short paragraph to 39 pages, as is the case with the word *Kupelofen* (cupola). This work runs to 748 pages of text covering 5,000 headings. It is both generously and clearly illustrated, and has a wealth of tabular matter. In browsing through the book, two or three decades of foundry developments are revealed, *viz.*, from Perlit iron; Emmel iron; Meehanite metal, right up to spheroidal-graphite cast iron.

Interesting sections are devoted to the history of foundry practice. Here it is learnt that in 1700 an Englishman, Wright, invented the cupola but not specially for melting cast iron, whilst Wilkinson, in 1788, is credited with the invention of the coke-fired cupola. There are a few printer's errors in this section, *e.g.*, Duv Dudley, whilst Smeaton is spelt Sineaton. The calendar of foundry developments finishes in 1953, with the launching of the metallurgical blast cupola. A quite interesting section, here, is devoted to art castings.

This is the type of book which is full of surprises, such as the heading "Corsalli" process. Many years ago, the reviewer remembers the claim that it was possible to cast horse-shoes direct from the cupola by enveloping the coke with some lime or clay so that combustion was delayed until the fusion zone was reached.

The book carries about 100 pages of advertisements and concludes with a buyers' guide for castings, foundry plant and materials. Readers interested in acquiring this comprehensive and enlightening book should carefully note the difference in price before November 15 and later.

V. C. FAULKNER.

Publications Received

Prospectus of Part-time Courses 1958-59. Issued by the Borough Polytechnic, Borough Road, London, S.E.1.

The part-time courses in foundry practice covering the requirements of the City and Guilds of London Institute's examinations are detailed in this brochure. They cover four-years' work, at the end of which the students may take the final examination. Additionally, evening classes are announced covering courses for those wishing to qualify for the entrance examinations of the Institution of Production Engineers, specializing in foundry technology. A second-year course is to be arranged in this category.

Transformation Characteristics of Direct-hardening Nickel-alloy Steels. [New edition.] Published by the Mond Nickel Company, Limited, Thames House, Millbank, London, S.W.1.

In addition to the isothermal diagrams and end-quench hardenability data previously reproduced, this atlas of isothermal-transformation diagrams of nickel steels incorporates supplementary information in the form of continuous-cooling transformation diagrams. These cover the range of cooling rates involved in the oil-quenching of one to six-in. dia. bars, and help to resolve the difficulties of practical application presented by isothermal data alone.

John Allan—at the Service of Industry for 60 Years. Issued by John Allan & Company (Glenpark), Limited, Glenpark Road, Glasgow, E.1, and elsewhere.

There is a certain amount of obscurity about the early history of this firm—it is known only that it began in a tiny workshop in a back street. However, a start was made as metal refiners, and this business has been continued with ever-increasing success as is well told in the booklet. In 1948, the company joined the Metal Industries Group and it now operates a second plant in Oldbury.

Personal

Mr. G. J. NORMAN CHERRY has been appointed a director of Foundry Services International, Limited, of Birmingham.

Mr. J. H. FURNIVAL, who has been a director of the Wolverhampton Metal Company, Limited, for many years, has been appointed vice-chairman.

Mr. LESLIE W. FARROW, chairman of C. C. Wakefield & Company, Limited, parent company of the Castrol Group since 1943, celebrated his 70th birthday on October 7.

Meriton Foundry, Limited, Bristol, announce that Mr. J. E. ALLCOCK, M.I.B.F., has recently been appointed chairman and managing director. Mr. J. GLANVILL has resigned.

Mr. W. T. WREN, chairman of Allied Ironfounders, Limited, has retired from the board for reasons of health, and following a recent motor accident. For the time being the chair will be taken by Mr. W. H. SMITH, the vice-chairman.

Mr. W. G. MARTIN, at present deputy overseas manager of A. Reyrolle & Company, Limited, will succeed Mr. C. A. STEPHENS as overseas manager. Mr. Stephens will retire from his executive duties on October 20 but will remain on the board.

Mr. K. CHATTERTON, who has recently returned to this country from India after many years' experience in steel and enginering work there, has been appointed chief engineer of English Steel Corporation, Limited, Sheffield, in succession to Mr. W. H. ALVEY, who has retired.

Mr. BRIAN WOMERSLEY, a 28-year-old Keighley metallurgist, who is personal assistant to the managing director of Keighley Laboratories, Limited, metallurgists, Croft House, South Street, Keighley, has been adopted as the prospective Conservative candidate for South East Leeds.

Vice-Admiral SIR FRANK MASON has been appointed a member of the Council for Scientific and Industrial Research. Sir Frank is a director of Metal Industries, Limited, and H. W. Kearns & Company, Limited. He was appointed chairman of the Mechanical Engineering Research board last June.

Mr. J. H. JOHNSON, a member of the foundry staff of F. Parramore & Sons (1924), Limited, ironfounders and engineers, Caledonia Foundry, Chapeltown, Sheffield, has been presented by Mr. ERNEST PARRAMORE, chairman and managing director, with a gold watch in recognition of 30 years' service.

Mr. GEORGE TAYLOR has been appointed assistant general manager of Head Wrightson Steel Foundries Limited, Stockton-on-Tees. Mr. Taylor, who began as an apprentice with Head Wrightson & Company, Limited in 1932, was appointed works manager of the company's Stockton branch two years ago.

Dr. R. F. WEBB, B.SC., PH.D., formerly a lecturer in Natural Sciences at Cambridge University and a Fellow of Trinity Hall, Cambridge, has joined the staff of CIBA (A.R.L.) Limited, Duxford, where he will direct the activities of a number of specialist groups engaged in long-term research in new plastics materials.

Mr. G. NORMAN RODGERS, assistant secretary of Newton Chambers & Company, Limited, has been appointed deputy secretary of Ransomes & Rapier, Limited, which was merged with Newton Chambers last April. Mr. Rodgers will succeed Mr. H. C. HORSUP as secretary when he retires next summer, after some 40 years' service with Ransomes & Rapier.

Presentations of wallets of notes were made by Mr. GEOFFREY SHAW, managing director of W. Shaw & Company, Limited, at Wellington Steel Foundry, Middlesbrough on October 3, to three employees who retired after a total of 124 years' service. They were, Mr. R. PRYDE (53 years' service), Mr. J. ADDISON, foreman fitter (46 years), and Mr. A. HALL (25 years' service).

Mr. R. F. HATTO, sales director, of Wolf Electric Tools, Limited, retired on September 30. Mr. Hatto joined S. Wolf & Company, Limited, as the firm was then known, in 1913, in a junior capacity and quickly graduated to the sales side of the business. He was subsequently appointed sales manager of the electric-tool division, becoming sales director in 1939.

Mr. J. B. LOGAN has been appointed works manager to Jones & Campbell, Limited, Torwood Foundry, Larbert. He began his career as a foundry metallurgist with Federated Foundries, Limited, leaving them to take the diploma course at the National Foundry College, Wolverhampton. Prior to joining his present company, Mr. Logan was foundry manager with Carron Company.

Mr. JOHN NEILL, a director of Robert Neill & Company (Sheffield), Limited, electrical engineers and factors, was adopted as Parliamentary prospective Conservative and Liberal candidate for the Park division of Sheffield on October 2. He is the son of Alderman ROBERT NEILL, a former Lord Mayor of Sheffield, and served his apprenticeship with Metropolitan-Vickers Electrical Company, Limited, at Trafford Park, Manchester, later studying for his B.Sc. at Leeds University.

Mr. H. O. PEAKE has been unanimously invited by the board of Harrisons & Crosfield, Limited, to become life president. The resolution will be submitted at the annual meeting next December. Last month Mr. Peake completed 50 years' service with the company, which coincides with its 50th year as a limited company. He joined the board in 1919 and was elected vice-chairman in 1924, on the same date that the late Sir Eric Miller became chairman. As life president he fills a position vacated by Sir Eric's death.

British Internal Combustion Engine Research Association announce that VISCOUNT FALMOUTH has been re-elected president of the Association; Sir HAROLD ROXBEE COX, Mr. H. N. PEMBERTON (chief engineer surveyor, Lloyd's Register of Shipping), Professor O. A. SAUNDERS, and Brigadier S. A. STEWART (director, Royal Engineer Equipment, Ministry of Supply) have been re-elected vice-presidents. Rear-Admiral W. F. B. LANE (Deputy Engineer-in-Chief, Admiralty) has also been elected as a vice-president. Mr. G. B. R. FEILDEN and Mr. V. H. HOPKINS have been elected to the Council in succession to Mr. G. W. BONE and Mr. A. C. YEATES, who retired by rotation. The Council have elected Mr. B. D. GIORDAN as their chairman, and Mr. Hopkins as their vice-chairman.

CFA Training Officer appointed

Mr. F. C. Hayes, A.I.M., has now been appointed Training Officer to the Council of Ironfoundry Associations and will be taking up his post on December 1. Mr. Hayes is of British nationality but was brought up in Vienna and later went to the Prague Technological University, obtaining a degree in physics and applied mathematics. From 1941 until 1955 he taught and lectured in the physical sciences and then became education officer of the British Iron and Steel Federation. He is already the British Iron and Steel Federation's representative on the City and Guilds of London Institute's Education Committee.

News in Brief

INGOT FOUNDRY COMPANY, LIMITED, has plans to erect extensions to the works at Wakefield Road, Brighouse, Yorks.

STEELS ENGINEERING PRODUCTS, LIMITED, Glasgow, are to supply eleven mobile cranes for goods stations in the Scottish Region.

THE NAME of the Aerograph Company, Limited, 47, Holborn Viaduct, London, E.C.1, has been changed to the Aerograph-DeVilbiss Company, Limited.

THE MORGAN CRUCIBLE COMPANY, LIMITED, was awarded the second prize in the educational class of this year's "Minibition" held in connection with the annual meeting of the Purchasing Officers' Association.

SLOUGH METALS, LIMITED, Oxford Avenue, Slough, announce that Mr. J. E. Twiss, who was until recently a development engineer with the Dowty Group has been appointed manager of the gravity-die-casting foundry.

IN THE BEST INTERESTS of industrial safety, Wolf Electric Tools, Limited, in conjunction with the British Safety Council, have designed and prepared a special electric-tool safety poster bearing the message "Electric Tools Can't be Careless—But You Can."

BARWORTH STEEL WORKS, LIMITED, makers of tool- and high-speed steels, Sheffield, is making provision for the installation of continuous casting equipment in new works at Ecclesfield. At present the firm sends their steel to hire rollers for further processing.

THE PRINCIPAL GUEST at the Materials Handling Convention held earlier this week at the Hotel Metropole, Brighton, was Mr. Joseph F. Lockwood, chairman of Electric and Musical Industries, Limited, who addressed the delegates at the Convention dinner.

NATIONAL FREE PISTON POWER, LIMITED, a subsidiary of the Hawker Siddeley Group, has been awarded a contract by the Iraq Petroleum Company, Limited, for a 3,000-h.p. free-piston gasifyer turbo-pumping unit for erection on their pipeline in Syria.

UNION CARBIDE, LIMITED (Alloys Division), announce the appointment of Mr. Colin Dunger to the position of area sales manager of the Northern England territory. His appointment is effective immediately and he will have his office at the Wincobank, Sheffield, branch.

THE INSTITUTE OF WELDING announce that their annual dinner will be held at the Park Lane Hotel, London, on November 5, and the autumn meeting on November 6 and 7. Details are available from the secretary, 54, Princes Gate, Exhibition Road, London, S.W.7.

A NEW FACTORY for the manufacture of oxygen and dissolved acetylene has been opened by British Oxygen Gases, Limited, on the Raynesway Industrial Estate at Derby. The company now has 46 oxygen-producing and compressing centres, and 20 for dissolved acetylene, in operation throughout the country.

A DISMANTLING SQUAD began work on October 8 at Blackness Foundry, Dundee, which closed down three weeks ago. This followed an announcement that the owners, Urquhart Lindsay & Robertson Orchar, Limited, had reached an agreement with the trade unions over the disputed removal of machinery from the works.

THE NORTHERN IRELAND DEVELOPMENT COUNCIL announced recently that Camco Incorporated, of Houston, Texas, USA, is establishing a wholly-owned subsidiary in Belfast. This subsidiary, Camco, Limited, will manufacture equipment for export to all the oil-producing areas of the world except the USA.

SOAG MACHINE TOOLS, LIMITED, Juxon Street, Lambeth, London, S.E.11, have opened an exhibition of new grinding machines by Wotan, Elb & Schmaltz, at their London showrooms in Hester Road, Battersea. The exhibition closes on October 17. (Hester Road is the first turning left from Battersea Bridge Road on the south side of the river.)

PURCHASING OFFICERS' ASSOCIATION announce that Mr. Charles Frederick Huebner, who has been chief buyer for British Oxygen Company, Limited, since 1947, has been elected president, and Mr. Walter H. Parry, who has been chief purchasing agent for Simplex Electric Company, Limited, since 1948, has been elected national chairman.

THE RT. HON. LORD PIERCY, C.B.E., chairman of the Industrial and Commercial Finance Corporation, Limited, is to give the opening address at a one-day conference on "Finance for Industry." The conference will be held at Earls Court next April in conjunction with the Factory Equipment Exhibition. Lord Piercy will also take the chair for the morning session.

R. W. CRABTREE AND SONS, LIMITED, engineers and printing-press manufacturers, Water Lane, Leeds, are to be the first company which the Queen and the Duke of Edinburgh will visit on their tour of Leeds on Friday, October 17. The royal visitors will see machine tools at work, Swiss steel-cutting machines, and samples of the off-set and rotary presses in which the firm specializes.

WICKMAN, LIMITED, Coventry, announce that Mr. J. Hodkinson has been appointed a director of the company with overall responsibility for the company's machine-tools export interests. He will retain his present appointment as managing director of Machine Tools (India) Private, Limited (a Wickman associated company), which he assumed upon joining that company in June 1954.

AT the meeting of the Non-Ferrous Club held at the Queen's Hotel, Birmingham, on October 1, Mr. G. R. Wolff, of the Commercial Metal Company, Limited, in an entertaining talk described and defended the operations of the London Metal Exchange. At this meeting a collection was taken on behalf of the National Society for the Prevention of Cruelty to Children, the sum of £19 being realized.

SIR WALTER BENTON, chairman of the United Steel Companies, Limited, opened a hostel for students of Samuel Fox and Company, Limited, Stocksbridge, on October 10. The hostel was originally Stocksbridge Vicarage which was bought by the company. Adaptations have now been made and a wing added. Sir Walter recalled that the company's founder, Mr. Samuel Fox, built the vicarage 70 years ago.

FOLLOWING THE SUCCESS of the initial equipment supplied, Wild-Barfield Electric Furnaces, Limited, of Watford, Herts., have received a repeat order from Wellworthy, Limited, Lymington, Hants., for a gas-carburizing installation operating on the drip-feed principle with "Carbodrip." The furnace has a usable work space of 24 in. dia. and 34 in. deep, and will be employed for gas carburizing gudgeon-pins.

AN "OPEN DAY" was arranged by ICI Metals Division, Limited, at Witton, Birmingham, on October 4, to enable the public to have their first view of the new titanium plant. Visitors saw many processes and inspected the remote-control room from which the melting process is observed in furnaces in enclosed concrete surrounds. They also saw the forge where one-ton ingots of titanium are handled mechanically while being hammered or pressed.

News in Brief

PLANS ARE ANNOUNCED by William Doxford & Sons (Engineers), Limited, Sunderland, for the construction of Doxford engines in a range up to 14,000 b.h.p. At present the most-highly-powered engine produced is of six cylinders 650-mm. bore and turbocharged, and is designed to maintain 8,000 bhp in regular service at about 115 rpm. Experiments are also being conducted with a single cylinder engine which could be produced with a substantial reduction in overall length and weight.

TOO MANY castings which could be produced in Scotland were being imported from abroad, said Mr. James Ferguson, managing director of Lane & Girvan, Limited, Caledonian stove and iron works, Bonnybridge, in his presidential address in Glasgow last Saturday to the Scottish branch of the Institute of British Foundrymen. Scottish foundrymen had to familiarize themselves with new products and techniques if Scotland was to hold its traditional place in the production of castings.

THE FEDERATION OF BRITISH INDUSTRIES announce that George Cohen Sons & Company, Limited, one of the 600 Group of Companies, have, on their behalf, sold the British Industry Pavilion at the Brussels International Exhibition. The floor area of the Pavilion is 60,000 sq. ft., and the building is completely clad with curtain walls of special polished plate glass. It will be re-erected at Hilversum, Holland, as a sports hall, and may also be used for big congresses in Hilversum since it should accommodate some 3,000 people.

CRAVENS, LIMITED, rolling-stock manufacturers of Darnall, Sheffield, have received an order for the design and construction of 12 new prototype carriages for London Transport Central Underground line. The exterior of the carriages will be unpainted aluminium. This is the first time the firm has done work for the Underground. The order, with electric gear to be supplied separately, is worth about £450,000. If the prototypes are accepted following trials early in 1960, the London Transport will ask for tenders for 330 more.

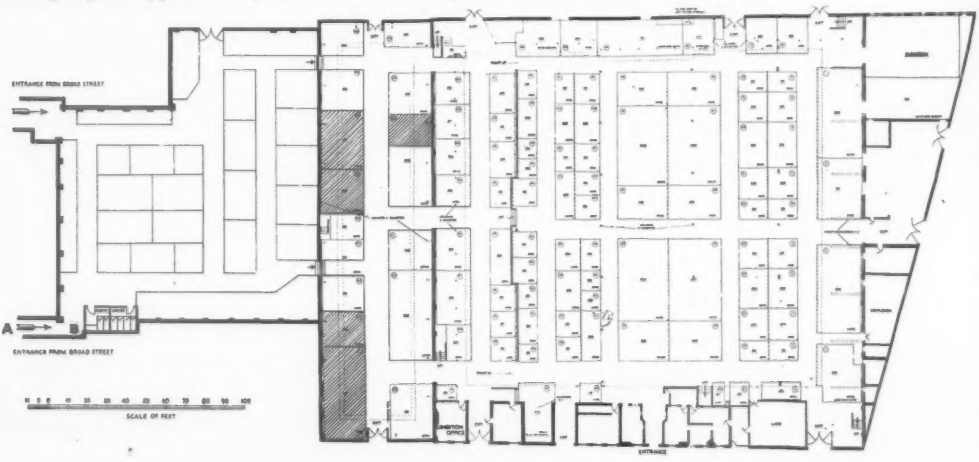
BIRMINGHAM PRODUCTIVITY ASSOCIATION'S 25-man mission to Germany returned on October 1. Members toured industry in Düsseldorf. Mr. Norman Hare, leader of the mission, said that the impression formed was that the UK is still one step ahead in engineering techniques. This mission is the second that has been arranged by the Birmingham Productivity Association with the aim of keeping British industrialists informed about developments on the Continent. The Düsseldorf mission was particularly interested in West German light-engineering and electrical industries. The party was made up of both management and trade union sides of industry.

IBF Birmingham Branch. The attention of members is directed to the change of programme for next weeks meeting (October 22) recorded in "Forthcoming Events," page 466, of this JOURNAL. This has been made necessary as the prospective lecturer, Mr. Zehnder, has cabled that he is unable to come from Switzerland for that date as had been expected. Instead, Mr. I. C. H. Hughes from BCIRA has agreed to "fill the breach," with a paper on "Shrinkage and Porosity in Grey-iron Castings." Mr. Zehnder will now give his postponed lecture in the lecture hall of the Byng Kenrick Suite, College of Technology, Gosta Green, Birmingham, at 7.15 p.m. on December 17.

Foundry Exhibition

Bingley Hall, Birmingham, May 21 *to* 30, 1959

This plan of Bingley Hall shows the current position of the space-letting for the forthcoming Foundry Exhibition, the shaded portions showing the position of the stands which are still available. It clearly indicates the urgency for application by those who have not yet formulated their plans but desire to be represented at what is already the largest exhibition of foundry plant ever to be staged in this country. Letters on the subject should be addressed to Herbert Daniel Exhibitions, 3, Clifford Street, London, W.1.



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Raw Material Markets

Iron and Steel

The ironfoundries are maintaining a steady rate of output of castings and overall production shows no appreciable fluctuation. Business generally is only moderate. High-duty castings continue in biggest request; the engineering and speciality foundries are able to obtain reasonably good levels of production, although activity is less than that of a few months ago. The motor-car industry, while not scheduling so heavily, continues to take up appreciable quantities of castings and it is expected that these requirements will increase later. The call for castings from these foundries for many other essential trades is also at a fairly good level. Their usage of pig-iron, including the low-phosphorus grade, hematite, and refined irons, has declined in proportion to their reduced outputs of castings and available supplies of all these irons exceed consumption. In the low-phosphorus irons, which are now obtainable in additional brands, producers are unable to dispose fully of their makes. Hematite makers have tonnages to spare, while producers of refined irons are searching for more business.

The foundries are carrying only sufficient stock as is essential to their production needs and the amount of work on hand. Stocks at the furnaces are adequate to cover urgent demands and this enables consumers to obtain deliveries promptly and to avoid the necessity for stocking, a procedure they prefer.

From some of the light foundries come reports of some improvement in business for castings. This is attributed to a reduction in stocks and also to the possible influence on trade by the relaxation in credit restrictions. Additional work is badly needed by these foundries.

More work is also required by most of the jobbing and textile foundries. High-phosphorus pig-iron, which is mainly used by the light, jobbing, and textile foundries, is available to satisfy any increase in demand; producers have appreciable tonnages in stock.

Foundries are able to obtain most of their scrap requirements without difficulty, the biggest demand being for the heavier and better grades of cast iron, which is less plentiful than other grades. Deliveries of foundry coke are satisfactory and ganister, limestone, and firebricks are readily obtainable.

Most of the re-rollers continue only moderately employed, with outputs much below capacity. Although there has been some slight improvement in the call for small bars and light sections, business generally is quiet, and rollings depend on day-to-day requirements. There is very little forward buying from home consumers, and in the export market orders are difficult to obtain against the reduced prices quoted by producers abroad. The rolling mills supplying reinforced rods have a fair amount of work on hand. Steel semis are plentiful and much larger tonnages could be supplied by home steelworks if demands warranted.

Non-ferrous Metals

Copper continues firm and is now fluctuating around £240 a ton—the highest level since May, 1957. The strikes in Canada and on the Copperbelt are having their impact and the losses of the metal are now totting up to sizable proportions. Not much headway towards a quick settlement in either country is being made, which means that Europe is going to be short of copper in the very near future. This fact has led to improved demand from the UK and from Europe, but, even so, the outlook is that the UK price will have to rise to a point which will attract copper from the US to satisfy the needs of European consumers.

Meanwhile, demand in the US is strong and the custom smelter price has again been raised a further ½ cent to 27½ cents a pound. This position reflects the improved situation and also the tight market for scrap. For a few days the gap between the custom smelter price and the producer's price was a full 1 cent. But the producer's have now extended their working week to five and a half days and also raised their price by 1 cent to 27½ cents a pound. With Wall Street still booming and steel production climbing steadily—the weekly production index is now over 70—the outlook is good, particularly, as the large stocks overhanging the market are firmly held. Stocks of refined copper in London at the end of last week fell further to the total of 9,600 tons.

Tin is slowly readjusting itself to its recently improved position. At the beginning of last week the price rose sharply owing to the much reduced offering of the metal in the new quota period. Subsequently, however, the price slumped almost as sharply on heavy selling of the metal in Singapore. Nevertheless, the overall picture is still reasonably bright as these sales have been absorbed and the spot price is still well clear of the support point of £730 a ton. More than that, the three months' quotation is holding the line at the floor price for cash metal and prospects are that the price will go higher rather than lower. In the United States the market is reasonably active and the price is around 96 cents a pound.

Lead continues to benefit from the recent imposition of import quotas and the American price is now standing at 13 cents a pound. Demand in the UK and in Europe is mainly for nearby metal. Yet there has been no real upswing in demand for lead either here or on the other side of the Atlantic and, in fact, stocks in the United States are still rising.

Zinc has been a fairly good market both here and in the United States, where the price is 11 cents a pound, East St. Louis. Demand in the UK and in Europe is not large, but is constant, while in the United States the improved steel position has brought in buyers for "Prime Western" and diecasters, despite the strikes in the US automobile industry, are still absorbing reasonable tonnages of metal.

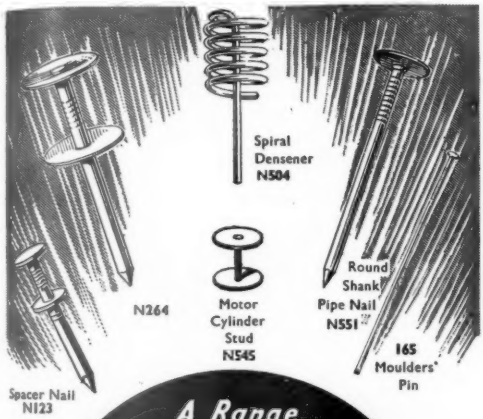
Board Changes

FIAT ENGLAND, LIMITED—Dr. G. Boella has been appointed a director. He was appointed general manager in 1956 and continues in that position.

STEWARTS AND LLOYDS, LIMITED—Mr. James Mitchell will resign from the board as from October 31. Mr. Mitchell joined the company in 1908 and has been a director since 1947.

G. A. HARVEY & COMPANY (LONDON), LIMITED—Mr. H. E. Cooper has been appointed managing director. He has been acting as deputy managing director since May last. Mr. I. A. Marriott has been appointed sales director in succession to Mr. P. T. Briss, who is retiring at the end of the year.

TWEEDALE & SMALLEY, LIMITED—Mr. Oscar Howarth (works manager), and Mr. John G. Doull (secretary), have been appointed to the board of directors. Mr. Howarth, who completes 50 years' service with the company on October 16, began work in the tool-room, where he became foreman, and was appointed a manager in 1939, and works manager in 1955. Mr. Doull joined the staff as an accountant in 1952, and was appointed secretary in 1956.



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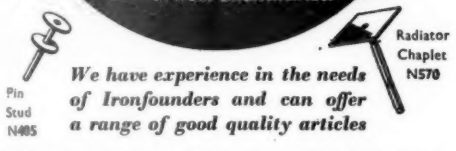

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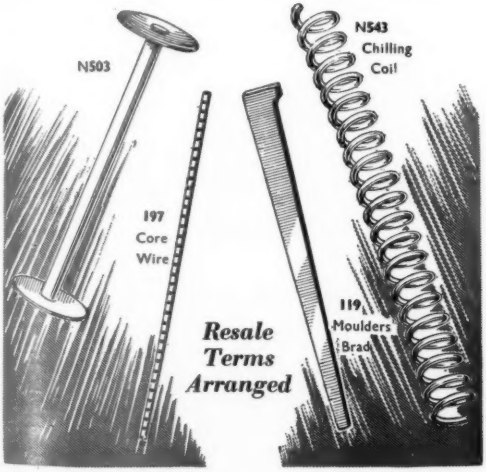

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In six grades all made to measure,
Casting then becomes a pleasure.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

October 15, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.: North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.: N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £44 0s. 0d. to £44 10s. 0d., scale 15s. 0d. per unit; 75 per cent. Si, £58 0s. 0d. to £62 10s. 0d., scale 16s. 0d. to 17s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 6s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 9s. 6d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £83 10s. 0d. to £87 0s. 0d., basis 60 per cent. Cr, scale 30s. 0d. to 30s. 6d., per unit; over 6 per cent. C, £79 10s. 0d. to £85 0s. 0d., basis 60 per cent. Cr, scale 30s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8½d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent. C* 1s. 9¾d. to 2s. 0¾d. per lb. Cr; 0.06 per cent. C,* 1s. 10d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £265 0s. 0d.; 96/98 per cent., £295 0s. 0d.

Ferro-columbium.—65/72 per cent., Nb + Ta, 19s. 9d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £78 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., £32 15s. 6d.; tested, 0.08 to 0.33 per cent. C, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), £34 17s. 0d.; silico-manganese, £43 16s. 6d.; free-cutting, £36 14s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E. Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £40 0s. 6d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, £39 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £44 16s. 0d.; black sheets (hand mill), 24g., £58 14s. 6d.; galvanized corrugated sheets, 24g., £66 16s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 11s. 0d.; nickel-chrome-molybdenum, £111 19s. 0d.

NON-FERROUS METALS

Copper.—Cash, £237 0s. 0d. to £237 10s. 0d.; three months, £230 0s. 0d. to £230 10s. 0d.; settlement, £237 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 4d. per lb.; rods, 256s. 6d. per cwt. basis; 20 s.w.g., 291s. 6d. per cwt.

Tin.—Cash, £744 0s. 0d. to £745 0s. 0d.; three months, £737 10s. 0d. to £738 0s. 0d.; settlement, £745 0s. 0d.

Lead (Refined Pig).—First half October, £74 15s. 0d. to £75 0s. 0d.; first half January, £76 10s. 0d. to £76 15s. 0d; settlement, £75 0s. 0d.

Zinc.—First half October, £72 0s. 0d. to £72 5s. 0d.; first half January, £70 15s. 0d. to £71 0s. 0d.; settlement £72 0s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £102 10s. 0d.; rolled zinc (boiler plates), all English destinations, £100 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £89 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10½d. per lb.; sheets to 10 w.g., 199s. 0d. per cwt.; wire, 2s. 8d.; rolled metal, 199s. 0d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £152; B6 (85/15), £187; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £205; HTB2 (38 tons), —; HTB5 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £191; LG3 (86/7/5/2), £201; G1 (88/10/2/½), £262; (88/10/2/1), £249.

Phosphor Bronze.—BS1400, PB1 (AID released), £207 per ton.

Leaded Phosphor Bronze.—BS1400, LPB1 (1060), £215 per ton.

Phosphor Bronze Strip, etc.—Strip, 292s. 6d. per cwt.; wire, 4s. 1¾d. per lb.; rods, 3s. 4¼d.; tubes, 3s. 4¼d.; chill cast bars: solids 3s. 3½d.; cored 3s. 4½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 9¾d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 2¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 1¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £78 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £234; AB2, —.

* Average 68-70 per cent.

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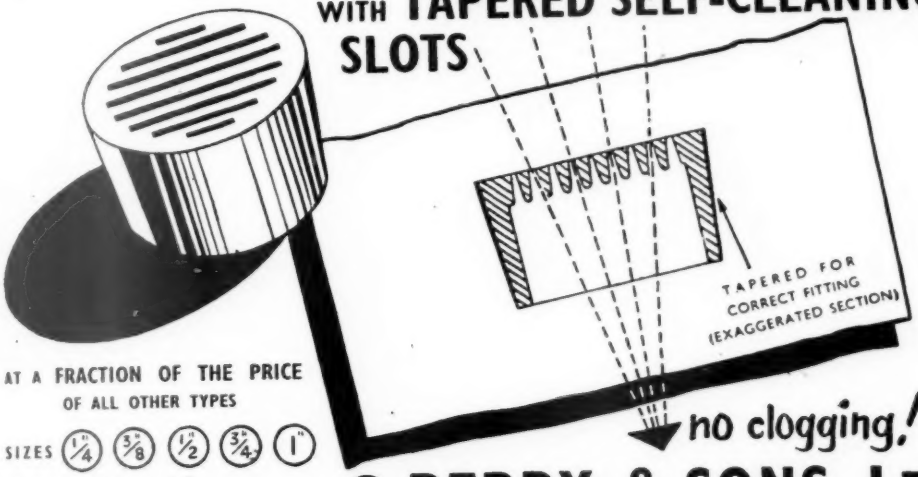

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Russians to use BISRA's System

Originally envisaged as a production aid in the manufacture of steel products, the advanced system of plant performance recording developed by the British Iron and Steel Research Association aroused considerable interest in engineering circles when it was introduced last year. It was at once apparent that the system had many potential uses throughout industry generally. One of the licensees, the Digital Engineering Company, Limited, Battersea, London, S.W.11, has been awarded an extensive contract for monitoring equipment of this type for a big Russian factory project.

The apparatus involved will equip some 500 "detection points" throughout a giant tyre plant for which the manufacturing machinery and equipment is being built and supplied by a consortium of British firms. Members of the consortium—known as Rustyfa, Limited—are David Bridge & Company, Limited; Crompton Parkinson, Limited; Lancashire Dynamo Holdings, Limited; Mather & Platt, Limited; Francis Shaw & Company, Limited, and Simon Handling Engineers, Limited, and the contract to date is valued in the region of £12,500,000. The consultants to the consortium, Dunlop Advisory Service, Limited, a direct subsidiary of the Dunlop Rubber Company, Limited, are responsible for the design and specification of the factory layout, machinery, and equipment.

The factory is to be erected near Dneipropetrovsk and is designed for the production of large numbers of tyres for cars, lorries, tractors, and heavy earth-moving equipment. Layout and operation will be based on the latest ideas in automation, necessarily involving extensive monitoring. The entire process of tyre and tube making is to be monitored hourly. Production figures will be obtained for the number of batches of rubber produced by the internal mixers, the number of yards of fabric, the number of extruded treads, or, in the case of giant tyre manufacture, the number of uncured and cured tyres, and the number of uncured and cured inner tyres.

All the counting equipment will be centralized, and an adjacent office will be equipped with page printers where the hourly production totals will appear coded according to size or type. Additional over-riding totals for each shift will also be produced and at these times something like a thousand characters of data will be printed out. Experience gained in supplying performance recorder units to several British firms led to considerable further development work by the Digital Engineering Company, and the fruits of this are being applied to the Russian project. When the factory comes "on stream" it should become one of the largest and most advanced tyre plants in the world.

Electric-powered Tractor

Thirty years ago an idea was born in the mind of Major A. McDowall, a Castle-Douglas farmer. He envisaged an electrically-powered tractor. Recently the first public demonstration of the tractor took place near Larbert. Looking complicated and modern in design, the tractor proved that ploughing by electricity is feasible. This prototype tractor for ploughing is powered by electricity led by cable from a 440-volt mains supply. With ploughs at either end, the tractor measures 35 ft. in length and is 10 ft. high, but the makers—Carron Company, Falkirk—and the Ministry of Power, emphasized that the model on view was merely a huge "test bed." It weighs almost five tons, a weight which could be halved with further developments.

Unsolved Clean Air Problems

Some of the research problems which remain to be solved in the attempt to achieve a high standard of "clean air" were outlined by Dr. R. Lessing in his second presidential address to the 25th annual conference of the National Society for Clean Air which opened on October 1 and which closed on October 3. The development of smokeless fuels, the removal of grit and dust from flue gases, and the problem of sulphur and motor-vehicle exhausts were three outstanding fields for research, he said. In particular he hoped that the oil and motor manufacturing companies would step up research into the cause and prevention of objectionable engine exhausts.

Dr. Lessing welcomed the new attitude of industry towards air pollution generally and to the NSCA in particular, and compared industry's support for the new Clean Air Act with the opposition that had been shown to the Smoke Abatement Act of 1926. The industrial aspect of the Act was taken up more fully later in the day when papers were given by Mr. G. W. Farquharson, chief smoke inspector of Birmingham, Mr. T. M. Ashford, senior smoke inspector, Glasgow, and Mr. N. Bastable, chief public health inspector, Barking.

With the exception of the scheduled processes controlled by the alkali inspectors of the Ministry of Housing and Local Government, the responsibility for the implementation of the new Act rests on local authorities, said Mr. Farquharson, but he wondered whether it would be overshadowed by other urgent local government matters or even if many local authorities had the staff available, or even the time to spare, to carry out enforcement duties.

Mr. Ashford dealt with various methods of dust and grit measurement and control, the dust and grit nuisance being, in his opinion, more intolerable and a source of more immediate danger, than smoke." "The Height of Chimneys" was Mr. Bastable's subject and, in addition to listing British requirements, he described current practice in America and Russia.

Spafford Centenary

Over 300 people attended a dinner and dance at the Cutlers' Hall, Sheffield, on October 2 to celebrate the centenary of A. Spafford & Company Limited, makers of agricultural machine parts, Imperial Works, Colver Road, Heeley, Sheffield. The firm has been the concern of four generations of the same family, beginning in 1858 when Abraham Spafford was a merchant and manufacturer of saws, files, edge tools, table knives and scythes, in Russell Street. His two sons joined the firm, and then the five sons of one, Edward, all joined. In 1932, the firm of Barker & England, Limited, of Heeley, was purchased. Then after the war, the foundry firm of Stephen Fisher & Company, Limited, was turned over to making agricultural parts. There are now eight direct members of the family concerned in the business which employs 250 people. Mr. Claude Spafford, the firm's chairman, returned for the centenary dinner from a Channel Island's holiday he was having after a long illness. At the dinner he presented three cheques for long service; to Mr. Bill Heald with 55 years; Mr. Ben Hall with 52, and Mr. Jack Deakin with 50. The chairman himself has been with the firm for 56 years.

A SIX-MAN steel mission left Tokyo last week for London to begin a month's tour of inspection of west European steel industries.

The framework of steel

Problem — how to organise a giant industry without stifling it

WE'VE tapped the power of the atom. We can send messages round the world in a flash. We stand on the threshold of space and with radio telescopes probe its ultimate depths.

And now we can see the answer to a challenge quite as formidable as these – and one which, in its undramatic way, affects our daily lives quite as much. You might sum it up like this: is it possible to make sure a giant industry is run in the national interest, *and at the same time give its native enterprise free play?*

Make no mistake. This *matters*. It could affect our whole standard of living. So it is a good thing for Britain that it *has* been proved possible in Steel – which sustains the fabric of all our other industries. The framework of the Steel Industry is such that there is a happy balance between Private Enterprise and Public Supervision.

STEEL'S SOLUTION

The Steel Industry is supervised by the Iron and Steel Board, with powers given it by Parliament. The Board is appointed by the Minister of Power – and he is responsible, through Parliament, to *you*. It is composed of a Chairman and two full-time Members, as well as iron and steel users, makers and trade unionists.

The Board controls steel prices. It sees that the Industry's plans for the future fit in with national plans. It has a say in all matters of major policy.

THE BIG BUT

But – a big But – this doesn't add up to rigid control from the centre. The man on the spot still runs his own show. His enterprise isn't fettered. He can still compete with other firms. He can still do his best to make and sell steel as efficiently and cheaply as ingenuity can manage. And he does.

There are more than 300 steel companies, scattered over Britain's green and smoky land. Some are huge concerns with over 20,000 workpeople. Others are tiny, with 50 men or less. Most are specialists, making sheet or plates, tubes or beams, stainless steel or special alloys.

The Board works out (with the Industry and the Government) what the country needs. Then it is up to the companies to provide it. *They* bear the financial risk. *They* furnish the technical skill.

TWO KEY WORDS

Of course there is co-operation as well as competition. The companies have their own organisation – the British Iron and Steel Federation. They co-operate in importing iron ore; in opening up new ore-fields and building ore carriers; in training and research; in anything that can be done better by working together.

So there are two key words to explain the framework of steel – *enterprise* and *supervision*. Both help to keep the Industry moving forward. It is a well-balanced system; and it works. Under it the Steel Industry is expanding faster than ever before.

Company News

WORSLEY MESNES IRONWORKS, LIMITED—Current accounting period will be the 15 months from July 1, 1957, to September 30, 1958. The 1958 accounts should not be expected until the end of this year or the beginning of next.

TUBE INVESTMENTS, LIMITED—The final dividend is being raised from 7½ to 10 per cent., to make 17½ per cent. for the year ended July 31, 1958, against 15 per cent. Trading profit of the subsidiaries expanded from £15,650,685 to £16,104,804, and the group net profit is nearly £500,000 higher at £6,003,438, compared with £5,510,909.

ROCKWELL ENGINEERS, LIMITED—The offer of the Coventry Gauge & Tool Company, Limited, to acquire the company's capital (five 10s. Coventry ordinary for four Rockwell 5s. ordinary) has been accepted by holders of over 90 per cent. of the shares. Subject to permission to deal in the new shares, the offer will become unconditional and binding. It remains open until January 5.

BABCOCK & WILCOX, LIMITED—The company is paying an interim dividend of 6 per cent. in respect of 1958. For the previous year an interim dividend of 7 per cent. was paid on the £7,524,398 ordinary capital, and a final of 6½ per cent., as forecast, on the present £9,405,497 capital as increased by a one-for-four rights issue. The directors also foreshadowed the payment of a total of 13 per cent. for the current year.

LAKE & ELLIOT, LIMITED, iron and steel founders, manufacturers of pressure equipment for petroleum and chemical industries, etc., of Braintree (Essex)—A final dividend of 7½ per cent. on a capital increased by a one-for-two scrip issue makes the equivalent of 10⅝ per cent. for the year ended July 31, 1958, representing an increase of 2½ per cent. Group profits contracted from £495,601 to £356,072. Tax requires £201,926 (£257,461), leaving a net profit of £154,146 (£238,140).

AIRSCREW COMPANY & JICWOOD, LIMITED, manufacturers of air conditioning and fan systems, etc., of Weybridge (Surrey)—The British Match Corporation, Limited, is to extend its offer for the ordinary capital of the company not already held by it to include the preference capital. Holders of the 6 per cent. preference stock will be offered 5½ per cent. preference stock in British Match in the ratio of £12 British Match for £11 Airscrew. It is hoped that the offer will be formally submitted within the next few weeks.

BROOK MOTORS, LIMITED—The directors announce a one-for-five scrip issue to ordinary shareholders of October 22 by a capitalization from share premium account. They expect to follow the 5 per cent. interim already paid with a recommended final dividend of 20 per cent. on the increased capital for the year to September 30, 1958. An extra-ordinary meeting to create 1,000,000 10s. ordinary shares and to effect the issue will be held at Huddersfield on November 5. Renounceable allotment letters in respect of the 288,273 new 10s. ordinary shares will be posted that day.

THOMPSON BROS. (BILSTON), LIMITED, manufacturers of aircraft refuelling units, galvanized plant, etc., of Bilston (Staffs)—The offer made by Lazard Bros. & Company, Limited, on behalf of John Thompson, Limited, boiler and ancillary equipment manufacturers, etc., of Wolverhampton, for the ordinary and preference capital of the company, has now been declared unconditional having been accepted up to October 2 by holders of over 92 per cent. of the ordinary and over 99 per cent. of the preference capital. The offer remains open for acceptance until further notice, but, in any event, until October 31.

Changes at the Hawker Siddeley Group

Further moves in the reorganization programme of Hawker Siddeley Group were announced recently by Sir Roy Dobson. These rationalize the production of medium and small diesel and petrol engines. Details of the new plan were worked out by Sir Roy with Sir George Briggs, who has executive responsibility for these operations. Commenting on the new plan, Sir George Briggs said the group was concentrating the production of their medium and small diesel and petrol engines at the Staines, Middlesex, factory of Petters, Limited. This follows a recent announcement that some of the engines previously produced by J. & H. McLaren, Limited, of Leeds, would be transferred to Petters. The small-engine production at Armstrong Siddeley Motors, Limited, Brockworth, will also be transferred to Staines.

Bryce Berger Moves to Gloster

For some time now, Bryce Berger, Limited, fuel-injection equipment manufacturers, have been expanding their range of products and were becoming restricted by their present factory space adjacent to Petters, Limited, at Staines. They, therefore, will move to the group's Gloster Aircraft factory at Hucclecote. The move of Bryce Berger will begin in about two months time and in the meantime there will be a building up of stocks so that there will be no interruption of supplies to customers. The move will take approximately six months and will be properly phased with dual staffs working at both the factories until the move is completed. The production of engines at Staines and Brockworth will be synchronized during the move so that there will be no break in the manufacture of the Armstrong Siddeley engines. Petters, Limited, will take over the Bryce Berger factory at Staines and will absorb the productive labour now working there, and a proportion of non-productive and technical staff. This will mean that Petters, Limited, will also be able to expand to cope with their increased production. Mr. D. K. Fraser, the present managing director of Petters, Limited, Staines, will be in charge of the two factories at Staines, and Mr. B. D. Giordan will conitnue as managing director of Bryce Berger, Limited.

Argentine Contract for Incandescent

The Incandescent Heat Company, Limited, Smethwick, has recently been awarded a contract worth more than £500,000 for a large coil-annealing installation at the new steelworks of the Sociedad Mixta Siderurgia Argentina (SOMISA). The order, obtained against strong continental competition, is for 25 single-stack coil-annealing furnaces with 72 bases, 32 forced-cooling hoods, and three exothermic-gas-atmosphere plants each rated at 10,000 cub. ft. per hour. The furnaces are built to the design of the Lee Wilson Engineering Company, Incorporated, of Cleveland, USA, for whom Incandescent are manufacturing licensees. The plant will handle coils up to 60-in. diameter in stacks of up to 168-in. high and will anneal annually 300,000 tons of cold-reduced sheet and tinplate. The equipment will be manufactured and completely assembled at the Smethwick works of the Incandescent Heat Company, Limited, the order being scheduled for completion within 12 months.

FOUNDRY EQUIPMENT, LIMITED, Leighton Buzzard, are to provide plant and equipment for a new brass foundry at St. Rollox Works, Glasgow.

F.&M.

REGD. TRADE MARK

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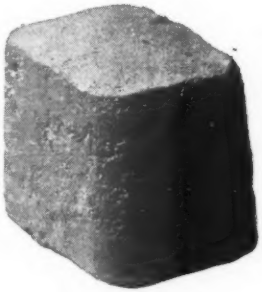

F. & M. MANGANESE BRIQUETTE

Many cupola charges require the addition of manganese to combine with the sulphur and form the comparatively innocuous manganese sulphide. Manganese is also needed in the production of cast iron having a medium tensile strength and is essential when a steel scrap is incorporated in the charge.

IN SOME CASES THE SIMULTANEOUS ADDITION OF SILICON AND MANGANESE IS NECESSARY AND F. & M. SILICON AND MANGANESE BRIQUETTES FORM AN IDEAL COMBINATION FOR THIS PURPOSE.

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Increases in Capital

KNOWLES FOUNDRY, LIMITED, Willenhall (Staffs), increased by £30,000, in £1 ordinary shares, beyond the registered capital of £10,000.

CONDER ENGINEERING COMPANY LIMITED, Winchester, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £20,000.

BOUND BROOK BEARINGS, LIMITED, Lichfield (Staffs), increased by £250,000, in £1 ordinary shares, beyond the registered capital of £150,000.

ELECTRONIC INSTRUMENTS, LIMITED, Richmond (Surrey), increased by £60,000, in £1 ordinary shares, beyond the registered capital of £100,000.

GEO. ROBSON & COMPANY (CONVEYORS), LIMITED, Sheffield, increased by £25,000, in £1 ordinary shares, beyond the registered capital of £5,000.

HARRISONS LISTER ENGINEERING, LIMITED, London, E.C.3, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £50,000.

C. J. DRIVER, LIMITED, engineers, etc., of Great Barr, Birmingham, increased by £10,000, in £1 shares, beyond the registered capital of £5,000.

HIGHFIELD GEAR & ENGINEERING COMPANY, LIMITED, Huddersfield, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £75,000.

PRATCHITT BROS., LIMITED, engineers, etc., of Carlisle, increased by £15,000, in £1 ordinary shares, beyond the registered capital of £20,000.

BURTON & DEAKIN, LIMITED, engineers, etc., of London, W.1, increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

COCKSEDGE (HOLDINGS), LIMITED, engineers, etc., of Ipswich, increased by £200,000, in 5s. ordinary shares, beyond the registered capital of £300,000.

HELIPEBS, LIMITED, engineers, founders, wire drawers, etc., of Gloucester, increased by £25,000, in £1 ordinary shares, beyond the registered capital of £75,000.

W. H. BLAKE & COMPANY, LIMITED, structural engineers, etc., of Sheffield, increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

JAMES NEILL & COMPANY (SHEFFIELD), LIMITED, steelmakers, etc., increased by £500,000, in £1 unclassified shares, beyond the registered capital of £1,500,000.

W. N. THOMAS & SONS, LIMITED, metal and scrap merchants, etc., of Slough, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £5,000.

SPOONER FOOD MACHINERY ENGINEERING COMPANY, LIMITED, Ilkley (Yorks), increased by £40,000, in £1 ordinary shares, beyond the registered capital of £60,000.

MARRYAT & SCOTT HOLDINGS, LIMITED, lift engineers, etc., of Hounslow (Middx), increased by £100,000, in 2s. ordinary shares, beyond the registered capital of £200,000.

LANDIS & GYR, LIMITED, electrical and general engineers, etc., of London, W.3, increased by £390,000, in £1 ordinary shares, beyond the registered capital of £360,000.

WILLIAM WILD & SONS, LIMITED, brass and bronze founders, etc., of Sheffield, increased by £65,000, in £1 ordinary shares, beyond the registered capital of £35,000.

GILBERT & HUNT, LIMITED, gearing manufacturers engineers, etc., of Huddersfield, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £25,000.

THOMAS MELDRUM, LIMITED, tool and component manufacturers, etc., of Sheffield, increased by £35,000, in £1 ordinary shares, beyond the registered capital of £15,000.

F. H. LLOYD & COMPANY, LIMITED, steelfounders, etc., of Wednesbury (Staffs), increased by £1,000,000, in £1 ordinary shares, beyond the registered capital of £1,760,000.

CLARKE, CHAPMAN & COMPANY, LIMITED, engineers, founders, etc., of Gateshead, increased by £1,180,000, in £1 ordinary shares, beyond the registered capital of £1,320,000.

FERRANTI, LIMITED, manufacturers of heavy electrical equipment, etc., Hollinwood (Lancs), increased by £1,000,000, in 10s. ordinary shares, beyond the registered capital of £3,500,000.

N. J. MUSCHAMP & COMPANY, LIMITED, mining engineers, etc., of Mansfield (Notts), increased by £50,000, in £1 ordinary shares, beyond the registered capital of £50,000.

ROBT. HYDE & SON, LIMITED, iron and steel founders, axle box manufacturers, etc., of Stoke-on-Trent, increased by £225,000, in £1 ordinary shares, beyond the registered capital of £250,000.

DAVRO IRON & STEEL COMPANY, LIMITED, Wootton, Bridgnorth (Salop), increased by £28,000, in 13,000 ordinary and 15,000 5 per cent. cumulative preference shares of £1 each, beyond the registered capital of £2,000.

ROAD MACHINES (DRAYTON), LIMITED, general engineers, etc., of West Drayton (Middx), increased by £50,000, in 49,500 unclassified shares of £1 and 10,000 founder shares of 1s. each, beyond the registered capital of £100,000

F. A. STANDEN & SONS, LIMITED, agricultural engineers, etc., of London, E.C.3, increased by £225,000, in 35,000 7½ per cent. cumulative preference shares of £1 and 760,000 ordinary shares of 5s. each, beyond the registered capital of £50,000.

G. W. S. BURDETT & COMPANY, LIMITED, machine-tool manufacturers, etc., of Peterborough, increased by £35,000, in 20,000 ordinary and 15,000 redeemable cumulative preference shares of £1, beyond the registered capital of £5,000.

Third Quarter Drop in Steel Production

Comparing corresponding quarters of 1958 and 1957, steel production in the first quarter of 1958 fell by 1 per cent., in the second quarter, by 10 per cent., and in the third, by 16 per cent. Steel production in September, the Iron and Steel Board stated last Thursday, averaged 368,600 tons a week, compared with 438,000 tons in September, 1957. Pig-iron production showed a corresponding decline from 282,700 tons last year to 230,900 tons a week in September.

Latest pig-iron and steel output figures (in tons), with the corresponding 1957 returns, are shown in the following table:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1958—July ..	227,000	11,805,000	315,900	16,426,000
August ..	221,000	11,492,000	299,200	15,558,000
September ..	230,900	12,009,000	368,600	19,169,000
Nine months ..	249,100	12,953,000	378,800	19,700,000
1957—July ..	263,400	13,695,000	362,500	18,848,000
August ..	272,500	14,169,000	373,400	19,417,000
September ..	282,700	14,698,000	438,200	22,789,000
Nine months ..	272,500	14,169,000	415,400	21,602,000

Obituary

Mr. HUGH SMITH MCMURCHY, managing director of Hugh Smith & Company, Limited, machine-tool manufacturers, Glasgow, collapsed and died in his office on October 3.

The death occurred recently at Winchester of Mr. R. C. GREEN, aged 88, who had been proprietor of the Vulcan Ironworks, King's Worthy, Hants, since 1919. He took a keen interest in the business up to the end of his life.

The death occurred on September 27, at the age of 88, of Mr. HERBERT CALAM, of Huddersfield. He was formerly employed for a period of 56 years by Wm. Whiteley & Sons, Limited, textile engineers, Lockwood, most of the time as chief draughtsman.

Mr. JOHN STEVENSON, well known in engineering circles in Scotland, has died. He was associated all his working life with the firm of Dawson & Downie, Limited, Elgin Works, Clydebank. He joined the firm in 1907 and was appointed secretary when it became a public limited company in 1916.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

SOUTH AFRICA, October 23—Air compressors. (ESB/24507/58.)

LEICESTER, November 3—Supply of sewerage ironwork castings. Documents from City Surveyors costing office, 1, St. Nicholas Street, Leicester.

SOUTH AFRICA, October 31—Horizontal gas-fired core oven. (ESB/24635/58.)

THAILAND, October 30—Rollers for crushing sugar cane and belt conveyors. (ESB/24732/58.)

PAKISTAN, October 20—Alwin Engineering Industries, Ireland Road (off Lawrence Road), Karachi have been granted sub-authorizations for the purchase of goods including foundry equipment and machine tools. (ESB/24486/58/ICA.)